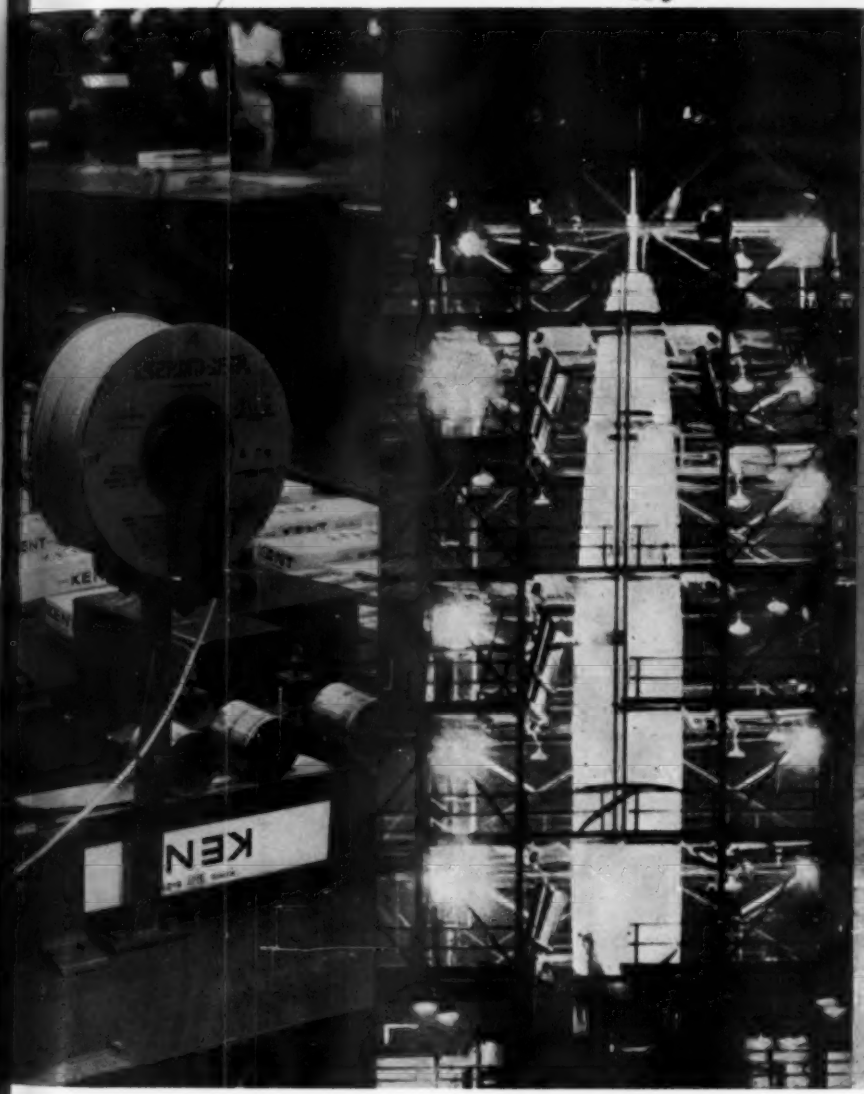
a|a

ECEMBER, 1960

ADHESIVES AGE

MANUFACTURE, APPLICATION, TECHNOLOGY, RESEARCH AND MARKETING

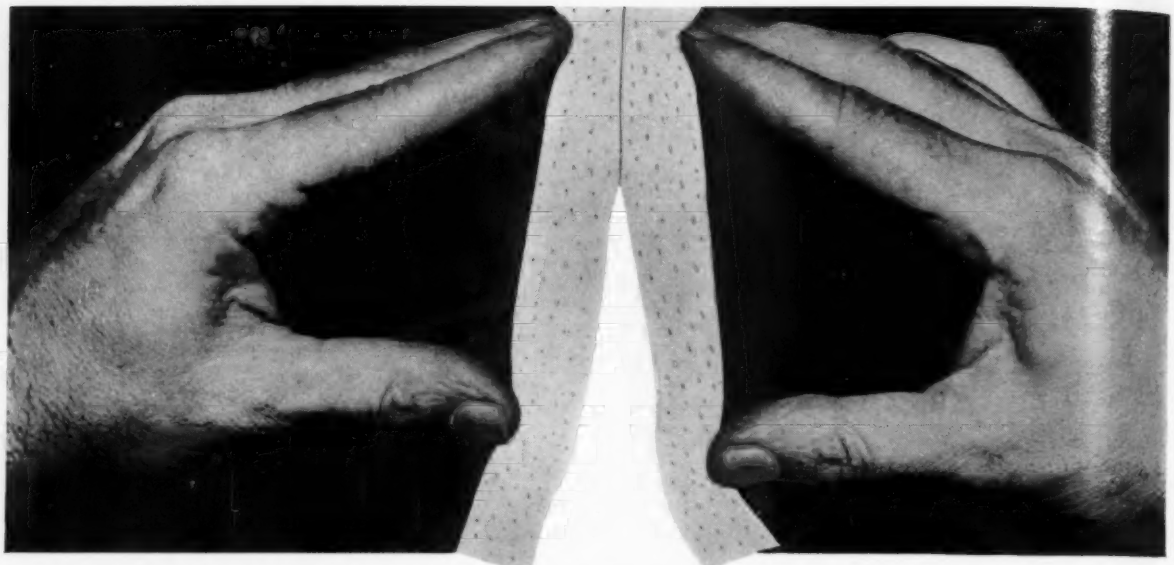
DEC · 1960



A REPORT ON CORD-LIKE HOT MELT ADHESIVES page 22

NEW ADHESIVES FOR JETS AND MISSILES page 38

SURFACE PREPARATION OF A LIGHT MURAL page 26



FOR *flexible* FOAM TO FOAM BONDING

REZ-N-GLUE 301

▶ New Schwartz adhesive produces dimple free, flexible bond of "tearing strength".

▶ Gives more footage per gallon for higher yield and lower unit cost.

▶ Brushes or sprays easily, sets rapidly for lower overall production economy.

Perhaps the best solution to date for foam to foam bonding is REZ-N-GLUE #301. Test after test in actual production proves the versatility and economy of this important new adhesive from Schwartz Chemical Co.—one of the pioneer names in plastics.

On all brands of polyurethane and rubber latex foams, REZ-N-GLUE #301 produces a flexible, dimple free seam with a bonding strength greater than the materials themselves.

It grabs faster, holds quicker, goes further, works cleaner, machines easily, takes less operational time every step of the way.

Suitable for automatic or hand operations.

IF YOUR PROBLEM IS BONDING FOAM TO NON FOAM

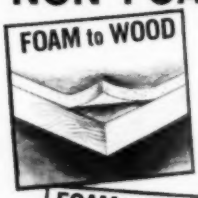
Thru the years Schwartz Chemical Co., has developed a variety of adhesives each designed to do a specific job.

For **foam to fabric or wood** for example, REZ-N-GLUE #234 has become a standard in the field.

For **vinyl to vinyl** VC-2 is perhaps the best known product of its kind.

Among the **non staining adhesives for vinyl foams** REZ-N-GLUE #306 has stood the test of time.

Whatever your specific adhesive problems may be, Schwartz probably has a product to suit your needs. You have merely to tell us what the problem is and our engineers will furnish, what in their opinion, is the kind of adhesive best suited for your particular operations and send you samples to prove it for yourself.



Serving the needs of the plastic industry

schwartz

CHEMICAL CO., INC.

50th Ave. — 2nd St.

Long Island City, N.Y.

ST 4-7592

THE LARGEST PLANT IN THE WORLD

MANUFACTURING COLORS, ADHESIVES, COATINGS & CLEANSERS EXCLUSIVELY FOR THE GROWING FAMILY OF PLASTIC INDUSTRIES

Protect the man...

and the equipment

with...

STABOND

*Hypalon coatings

... the versatile ozone and abrasion resistant coating for all surfaces

Actual photograph of prototype manned capsule containing the STAFOAM cushioned space couch coated with STABOND HYPALON T-200. Capsule is a major element of maneuverable satellite for rendezvous in space, under development by the Astro Systems Research Laboratories, Norair, Division of Northrop Corp.

The Freedlander Research and Development Laboratories at Hawthorne, California are available to research and provide exacting information for new STABOND applications

Space destined man and his equipment is protected by the thoroughness of research and resulting materials. Materials such as STABOND *Hypalon* coatings guard his oxygen hose, pressure suit and attending components against the wrath of ozone, weather and abrasion. His safety is further assured by STABOND *Hypalon* fire extinguishing coatings over fuel cell insulation. *Today*, more and more practical applications are being discovered for the miracle STABOND coatings, adhesives and sealants to protect the man and his equipment.

STABOND T-200 SERIES COATINGS ARE CURRENTLY BEING APPLIED TO...

- Rubber hose & couplings
- Rubberized shock mounts
- Crash pad cushioning
- Flexible fuel cells
- Interior head liners
- Hatch & door gaskets
- Rubber products
- Rubberized cloth
- Instrument boots
- Outdoor electric conduit
- Metal storage tanks
- Marine & industrial cable
- Exposed components
- Arctic clothing & equip.
- Fuel tank lining
- Exposed structures
- Hospital equipment
- Food processing equip.

* Dupont

ADHESIVES
COATINGS
SEALANTS

STABOND

AMERICAN LATEX PRODUCTS CORP.
3341 West El Segundo Blvd., Hawthorne, Calif.
ORegon 8-5021 OSborne 6-0141

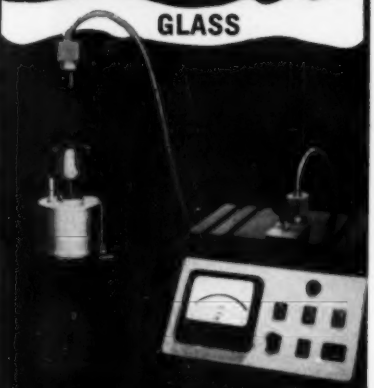
BRANCHES: San Francisco, 42 Gough St.; Seattle, 2231 5th Avenue; Dallas, 1300 Crampton St.; Houston, 15 Kendall St;

DIVISION OF DAYCO CORPORATION
*Headquarters for **new** ideas*

Dayco

VISCOSITY DETERMINATION

PLASTICS
PHARMACEUTICALS
LUBRICANTS
FOODSTUFFS
PAPER
ASPHALT
ADHESIVES
PAINTS
GLASS



HAAKE
ROTOVISCO
ELECTRICAL ROTARY VISCOSIMETER

The Haake Rotovisco is an electrical rotation viscosimeter which gives viscosity values on an indicator direct in the international Centipoise standard. It is the only absolute measuring unit currently available.

Depending on individual requirements, measurements may be made with any one of four measuring systems; either Plate-Cone attachment, Immersion attachment, Suspension attachment or Continuous Flow attachment.

SEND FOR COMPLETE DESCRIPTIVE CATALOG A 25

BRINKMANN

BRINKMANN INSTRUMENTS, INC.
115 CUTTER MILL ROAD, GREAT NECK, N. Y.

ADHESIVES AGE

AA

In This Issue

Cord-Like Hot Melt Adhesives—By *G. V. Upton*

The inherent advantages of hot melts are emphasized by an adhesive system born of the marriage of chemistry and engineering 22

Epoxies and KLM's Mobile Light Mosaic—By *Wilfred LeBrun*

Adhesive formulations based on epoxy resins contribute to the success of a dynamic panorama of light, color and motion 26

42,000 Square Feet of Tile Bonded to Curtain Wall Panels

More than seven million ceramic tiles are bonded to asbestos board and fiber glass panels to form the facade of the Alberta Wheat Pool Building 29

Bonding Concrete and Mortar to Themselves and Other Structural Materials—By *R. J. Schutz*

The mixing and application of simple, two-component systems that are based on blends of epoxy and polysulfide 30

Adhesive Bonded Brake Linings Investigated—By *Cord Lipe*

Introduced only a few years before World War II, techniques for bonding brake linings have gained acceptance in the auto industry 32

About the Cover Photographs

This month's cover spotlights three feature articles in the issue. At the far left, the photo of production line sealing of cigarette cartons with cord-like hot melts focuses attention on one of the many uses for these versatile adhesives. The center panel is related to the article on inorganic and ceramic adhesives for missiles and jets. The remaining photo shows various sized grit being imbedded in an epoxy coated mural panel to help break up light reflection.

The opinions expressed by authors and contributors to ADHESIVES AGE are not necessarily those of the editors or publisher. Articles appearing in ADHESIVES AGE may not be reproduced in whole or in part without the express permission of the publisher.

PP PALMERTON PUBLISHING CO., INC.

DECEMBER, 1960
VOL. 3, NO. 12

Adhesives in Tableware

A California manufacturer uses urea-formaldehyde adhesive and wood flour to make modern dishes 35

Pressure-Sensitive Labels—*By John S. Torrey*

Some factors to consider in selecting pressure-sensitive labels for a variety of surfaces 36

Developing Ceramic and Inorganic Adhesives for Missiles and Jets—*By D. V. Rosato*

Adhesive formulations developed to meet the extreme requirements of the Space Age offer from 1000 to 3000 psi at 1000°F. 38

Sealing Bronze and Granite Curtain Wall

Polysulfide compounds seal the John Hancock Insurance Building against wind and weather 41

Room Temperature Gluing with Electric Presses

Successful use of electric presses for room temperature gluing is a distinctive process requiring special techniques 42

Epoxies Bond Polyester Traffic Markers

Permanently bonded glass and polyester "dots" mark lanes of a California highway 43

Adhesive Facilitates Metalizing

Use of a polyester adhesive eliminates expensive and complicated surface preparation 44

DEPARTMENTS

Book Reviews	62	Names in the News	52
Capitol Cues	14	New Adhesives	10
Classified Advertisements	65	New Equipment	60
Coming Events	54	News of the Industry	45
Consultant's Corner	8	Noted in Passing	66
Editorial	7	On the Continent	18
Patent Review	58		

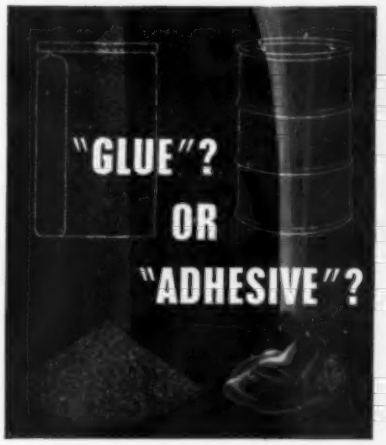
Indexed in Industrial Arts Index and Engineering Index.

© Palmerton Publishing Co., Inc., 1960

10,600 Copies of This Issue Printed

ADHESIVES AGE is published monthly by the Palmerton Publishing Co., Inc. Printing Office, Bristol, Conn. Editorial and Advertising Office at 101 West 31st Street, New York 1, N.Y. Subscription in the United States, $5.00 a year; Canada, $5.50; Foreign, $6.00; Single Copy, 50¢. December, 1960. Volume 3, Number 12.

No matter what you call it...



—when you order a prepared ADHESIVE from your regular supplier, be sure to specify a product based on *performance-proved animal glue*—or

—if you use dry, granular animal GLUE in formulating your own adhesive mixtures, take advantage of the quality and economy of DARLING'S Improved Bone Glues.

One of these 8 should do your job most economically

GREEN STRIPE.....196-220 grams
ORANGE STRIPE.....171-195 grams
ORANGE STRIPE.....146-170 grams
RED STRIPE.....121-145 grams
RED STRIPE.....101-120 grams
RED STRIPE.....81-100 grams
BLACK STRIPE.....30-80 grams
GOLD STRIPE.....60-90 grams

Shipped in 100 lb. multiwall bags. For prices and technical information see your Darling representative or write

DARLING & COMPANY
GLUE DIVISION
4201 South Ashland Avenue, Chicago 9, Illinois

DARLING'S improved BONE GLUE

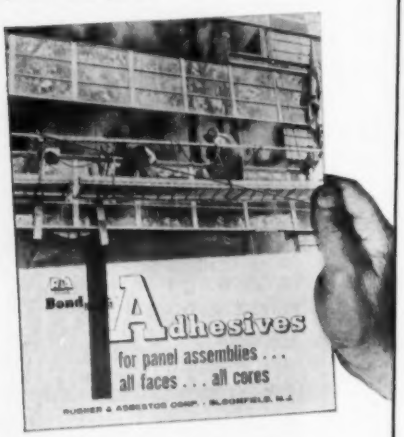
News about R&A SINCE 1913 **Adhesives**

FOR ALL METALS AND ALL PLASTICS

More sprayable "panel" adhesive cuts costs, boosts heat-resistance

Bond*master*® G586 *is one of a series...*

The BONDMASTER "G580 Series" of adhesives consists of a group of formulations which achieve sturdy bonds upon contact between the components. They are available in a full range of viscosities for "hot" or "cold" bonding with a wide choice of open times, heat resistance, clarity of dried film, etc., to meet your *specific* production needs.



Profusely illustrated, 16-page Brochure No. 135 describes adhesives and production methods used in manufacture of curtain wall and other panel assemblies consisting of a variety of cores and faces. Contains test data and details of mass production bonding techniques. *Send for your free copy today.*

R&A SINCE 1913

RUBBER & ASBESTOS
CORPORATION
247 BELLEVILLE AVENUE
BLOOMFIELD, NEW JERSEY

The improved spraying characteristics of hot-contact-bonding BONDMASTER G586 "panel" adhesive helps your production picture *five ways* because you:

1. Enjoy much faster and smoother area coverage;
2. Virtually eliminate over-spray and globular adhesive waste;
3. Cut your labor costs (it's far less "tricky" to spray);
4. Save substantially on processing time.
5. Attain measurably higher heat-resistance.

It all adds up to lower costs per square foot of completed panel . . . and with a production-proved adhesive that not only exceeds ASTM Test D1037-55T . . . (FPL) . . . but also has satisfied a multitude of more concentrated tests independently established by leading curtain wall fabricators.

BONDMASTER G586-20 is one of a group of formulations (see column on far left) we manufacture for the bonding of just about every type of panel produced today (paper, wood, plastic, or metal cores and/or faces).

WRITE FOR FURTHER DATA

Detailed data on the full range of BONDMASTER "G580 Series" panel adhesive is yours for the asking. We'll be glad to send a free evaluation sample as well if you will describe your specific bonding problem in detail.

Published Monthly by
PALMERTON PUBLISHING CO., INC.
Editorial and Advertising Offices
101 West 31st St., New York 1, N. Y.
Phone: PEnnsylvania 6-6872

P. L. PALMERTON, *President*
M. E. LERNER, *Vice-Pres. & Treas*
E. D. OSBORN, *Secretary*
CHARLES T. JANSEN, *Asst. Treas*

PUBLICATION STAFF

Editor and Publisher
M. E. LERNER

Managing Editor
B. J. KOTSHER

Associate Editor
STANLEY HOCHMAN

Assistant Editors
BERNARD M. BERNS
PHILIP D. SEGAL

Editorial Assistant
CHARLOTTE H. PEASLEE

Art Director
KENNETH T. CORELL

Circulation Manager
EDITH WAHL

Advertising Sales Manager
CHARLES T. JANSEN

Editorial Advisory Board

JOHN DELMONTE
Furane Plastics

JOHN H. FIELD
B. F. Goodrich Co.

BERNARD GOULD
Rubber and Asbestos Corp.

DALE G. HIGGINS
John Waldron Corp.

JOHN R. HUBBARD
Peter Cooper Corp.

W. E. KELLY
Goodyear Chemical

JACOB LICHMAN
Key Polymer Corp.

WALTER C. O'LEARY
Minnesota Mining & Mfg. Co.

FRANK W. REINHART
National Bureau of Standards

ROBERT T. SCHWARTZ
Wright Air Development Center

FRED WEHMER
General Adhesives Co.

EDITORIAL

To....

each epoxy maker, user
each and every bone glue chooser
one and all phenolic blenders
dextrine and to starch paste vendors
corrugators, blood glue buyers
latexers of cord for tires
glue pot makers, glue lap pasters
polymerizers, food glue tasters
coaters and to fabric sizers
adhesives market analyzers
chemists and to glue bond testers
users of the polyesters
impregnators and to tapers
those who work with board and papers
all of you and with good reason

A Merry, Merry Yuletide Season!

If a Better Adhesive will Better Your Product...

It's time to call Dural

SPECIALISTS TO ALL INDUSTRY

Whether your "joining" operations call for standard adhesives, or something entirely new and different... Call DURAL *First* on both counts.

For the same wealth of experience that adds superior quality to Dural regular adhesives also promises more successful solution of your really tough problems — for plastics, glass, leather, paper, wood, and other products. Tell us what you need. We can save you both time and money, perhaps improve your products and production.

Dural COMPANY, INC.
103 West Pierce Street • Milwaukee 4, Wisconsin

ADHAESION

This German language monthly journal reports on scientific and technical matters regarding all kinds of natural and synthetic adhesives, thickening agents, binding and bonding materials.

Subscription price for 1 year:
$12 (U.S. funds) including postage

Free sample copy on request.

Please write to:

HADERT - LEXIKON - VERLAG
Berlin W 30 (Germany)
Martin-Luther-Strasse 88A

CONSULTANT'S CORNER

By Dr. Irving Skeist

Phenolic Laminate

Question: We use a two-part, stopped resorcinol adhesive for bonding phenolic laminated material to itself. However, when fully cured, this formulation is hard and brittle, and our operations could benefit from a similar adhesive with some degree of flexibility.

We would like to retain all the properties of our present adhesive—especially its water solubility and ability to cure at room temperature. What can you suggest? Are there any resorcinol adhesives using synthetic rubber latex as a plasticizer?

Answer: This may be an excellent application for tire dipping compounds such as General Tire's Gentac. The latter is a synthetic rubber latex containing vinyl pyridine compounded with a resorcinol-formaldehyde resin. Tire dipping compounds are adhesives for bonding tire cord—rayon and especially nylon—to the rubber prior to vulcanization. Obviously, flexibility is a prime requirement in this end use.

Q-183

Edge-Gluing of Wet Veneers

Question: In order to assist in the automation of softwood plywood plants, it would be desirable to edge-glue, wet 1/10" to 3/16" Douglas fir veneers on contact. Could you suggest an adhesive that would perform this duty and yet withstand dryer temperatures of up to 400°F.

Answer: A resorcinol-formaldehyde adhesive might work. However, it appears to be impractical to edge-glue wet veneers at this stage of wood technology. Veneers shrink on drying, and the contraction is anisotropic—different in different directions, across vs. even with grain, heartwood vs. sapwood, narrow vs. broad rings. Wood experts advise that edge-gluing of the wet layers would result in warping, giving bowls instead of flat sheets on drying.

Q-174

Dr. Skeist is associated with Skeist & Schwarz Laboratories, Inc., 89 Lincoln Park, Newark 2, N.J. He is the author of the recently published book, "Epoxy Resins."

Cloth Belt Laps

Question: We are looking for an adhesive to be used for making cloth belt laps. The finished lap must be very flexible, resistant to water, kerosene and cutting oils, and must withstand temperatures up to 200°F. under tension. The lap can be cold pressed or hot pressed (250°F. maximum) for 15 seconds or less with pressure up to 1000 pounds per linear inch.

Answer: A nitrile rubber solvent cement, containing a curing agent, may be suitable. The bond will be weak at first since a 15-second exposure to 250°F. is hardly adequate for cure. In use, however, the bond strength should improve as the result of heat developed by friction.

If the initial strength requirements are such that it is not feasible to let the bond "work-harden," you will have to put more heat into the initial cure.

Q-176

More on Teflon

Dr. A. A. Benderly of the Diamond Ordnance Fuze Laboratories calls our attention to the simple, straight-forward method for bonding Teflon described by Nelson Kilduff and Benderly in *Industrial Engineering Chemistry*, Vol. 50, p. 329, and in U.S. Patent 2,809, 130, issued to G. Rappaport and assigned to General Motors.

The basis of the method is the pretreatment of the fluorocarbon plastic by immersion in a sodium-naphthalene bath. The bath is prepared by dissolving 23 grams of sodium in 128 grams of naphthalene and one liter of tetrahydrofuran. The technique is particularly suitable to small scale activity.

Paper Bags

Question: One of our talc suppliers has been having a great deal of trouble finding a glue for fastening palletized 50-pound bags of talc together. Can you recommend a high-shear-low-tensile strength glue for this purpose?

Answer: Here's another case where an adhesive is required to be good but not too good. The bags should stay together on the pallet, but should separate without tearing the paper.

Several companies have developed dextrin or starch-dextrin adhesives which provide a good "suction bond," but not a tear seal. National Starch's Load-Lok is one example. *Q-170*

Hardwood to Wall

Question: We are starting to manufacture ⅛" three-ply wall panels in 12" squares made with hardwood face. We would like a glue which can be used to bond these to walls or similar surfaces. Because the panels are thin, they could show a slight warp. The glue would have to be sufficiently strong to hold them in place immediately with hand pressure only.

Answer: Apply a neoprene contact cement to the panels, let the solvent evaporate, and cover the tacky surface with a silicone release paper which can be removed when the panel is to be affixed to the wall.

Q-175

LAMINATING FOILS?

PQ Silicates are great performers in bonding metal foils to various materials. They set to form high strength bonds—often stronger than the laminating materials used.

PQ Silicates as inorganic adhesives are odorless, non-poisonous, fireproof, vermin resistant, and non-corrosive.

Write us about your pasting or fabricating operations and let us send you a sample of the PQ Silicate to fit your needs.

PHILADELPHIA QUARTZ COMPANY
1060 Public Ledger Building, Philadelphia 6, Pa.

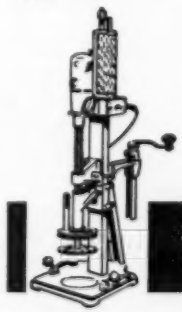
PQ SOLUBLE SILICATES

9 PLANTS • DISTRIBUTORS IN OVER 65 CITIES

Trademarks Reg. U.S. Pat. Off.

SEMCO

SEALANT MIXING AND APPLICATING EQUIPMENT for two part materials



- GUNS
- NOZZLES disposable
- CARTRIDGES disposable
- MIXERS

PATENTS 2,930,512, 2,989,017, 3,005,560

SEMCO SALES & SERVICE, INC.
1313 W. Florence Ave., Inglewood 1, Calif. • ORegon 8-5781

new adhesives

AND ADHESIVE PRODUCTS

Pressure-Sensitive Tape

Tapebinder Filament Reinforced Pressure-Sensitive Tape is recommended by its manufacturer for bundling, reinforcing, closing, sealing and palletizing of cartons, crates, boxes, kegs, barrels, etc. It is said to feature high tensile strength, excellent adhesion, minimum stretch, good flexibility, and to be weather and moisture resistant. Glass Filament Reinforced Tapebinder has a tensile strength of 300 pounds per 1 inch width, a maximum of 5 per cent elongation, and complies with Spec. PPT-T-97A, Type 2. Transparent Vinyl Rayon Reinforced Tapebinder is said to have exceptional bi-directional strength, and to meet Spec. PPT-T-97C, Type 1. Its manufacturer recommends it where shock resistance is of prime importance, where tape may contact sharp edges, or where it is desirable to read printing under tape. *A. J. Gerrard & Co.* **P-408**

Chuck-Hole Repair Material

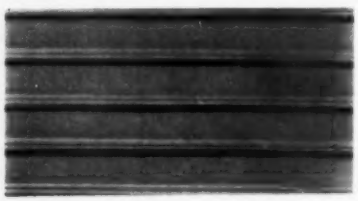
Revere Sta-Fil is a permanent exterior pavement patching material recommended by its maker for use in patching chuck-holes, ruts and various other types of deep holes in concrete, asphalt, brick, stone and cinders, caused by expansion cracks or pavement upheavals and enlarged by moving traffic. Said to be more permanent than the original pavement itself, the material is supplied ready-to use and can be applied cold at any temperature and during any weather conditions. *Revere Chemical Corp.* **P-409**

Aluminum Tape

Aluminum Template Tape is designed to eliminate painting of steel members where aluminum sheets are used, and to protect aluminum sheeting from galvanic action. The product, the manufacturer states, serves as template and reduces the time required for locating studs. No punching or cut ours are required for welding through the tape. A special dispenser permits fast application. *Nelson Stud Welding.* **P-410**

Silicone Glue Pad

A molded Silicone Rubber Glue Pad has been developed which can be used on Staude infold and outfold gluers, International right angle gluers, and Staude and International



cellophane window machines. The pads are molded with a rubber faced backing which permits easy mounting and prevents distortion of the pads, it is said. The pad can be furnished in almost any pattern, such as one piece pattern pad, individual strip pads, or gridded pads, each in keeping with the user's specifications. According to the manufacturer, advantages are: a good, even adhesive application; no interrupted glue line, or surface pad glue build-up, the product is non-adherent, no machine downtime for clean-up during normal run, no solvents needed in clean-up, no curl or distortion in storage, and the product can be used with any adhesive. *Acme Plate Corp.* **P-411**

Silk-Screening Stock

Tape-Stik is a silk-screening stock that is said to combine the economy of a plain paper sheet with the convenience of Kleen-Stik pressure-sensitive adhesive. It consists of a moisture-resistant, sturdy white H_2O-Proof Stock in handy-sized sheet, edged with two strips of preapplied 3/4-inch two-sided adhesive Dulb-Stik Tape. An advertising message can be screened on the taped side for use inside windows, glass doors, and showcases; or on the opposite side for use on walls, poles, auto bumpers, and many other locations. The big advantage of Tape-Stik, according to the manufacturer, is that displays are ready for use immediately after screening and cutting. *Kleen-Stik Products.* **P-412**

Bakelite Phenolic Trio

Bakelite CKR-2400, -2432, and -5254 have been made available in a new, free-flowing, granulated form. Granulation makes the resins easier to handle and store; it contributes to precise formulation as the resins can be weighed to any degree of accuracy without the necessity of breaking up large chunks; it speeds up production because the granulated resins melt faster. The resins come packed in 50-pound polyethylene-coated multiwall bags, and the manufacturer especially recommends their use for production of varnishes by the cold-mix technique. *Union Carbide Plastics Co.* **P-413**

TSI Tape Developed

The new Time Sterile Indicator Tape, known as TSI Tape, is geared to respond to the standard autoclaving or sterilizing cycle of 250°F. for a period of 15 minutes. The pressure-sensitive paper tape is constructed in portable form so that it can be cut and removed and placed on any type of package. The black word "sterile" appears on the tape after sterilizing at the required sterilizing cycle values The tape is specifically designed for hospital use. It provides a check on the efficiency of the operator, and identifies the condition of the product for the user. *Professional Tape Co., Inc.* **P-414**

Blister Pack Cement

XR-419 Special Cement for Blister Packs is a free flowing latex adhesive designed for any two-way dry stick applications requiring complete freedom from blocking when materials are stacked or when die cutting operations are carried on. It can be applied by hand, spray or machine, and although generally used as is, it can be diluted with water. Cleaning up is accomplished by water and detergent. *Manhattan Adhesives Corp.* **P-415**

Automation Labels

Able-Stik labels are intended to aid automation of production control by serving to identify items at all stages of manufacture or repair. Production line data can be imprinted directly on the label by data processing machines from control cards. *Allen Hollander Co.* **P-416**

PERMACEL
whatever the job . . . PERMACEL®
NEW BRUNSWICK, NEW JERSEY • TAPES • ELECTRICAL INSULATING MATERIALS • ADHESIVES

New Maraset Resin

Maraset resin 533A, a two-component, contact-pressure epoxy adhesive that can be cured at room temperature to provide high bond strength, is also a solvent-free, nonvolatile, medium-thick paste with a two-hour pot life. It meets MIL-A-8623, Type II, the federal specification for the aircraft industry. Designed for uses where it is impractical to apply heavy pressure or heat for hardening, it is primarily intended to join together aluminum, steel, brass, copper, magnesium, and combinations of these metals. Properties claimed by the manufacturer for the product include: low shrinkage, resistance to mechanical and thermal shock, high creep resistance under constant stress, low moisture absorption, and good resistance to water, oils, solvents, and aromatic fuels. *Marblette Corp.* **P-417**

Soft-Seam Adhesive

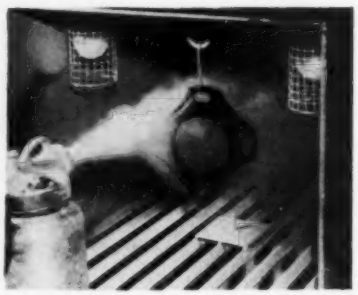
Bondmaster R379-20 is a strong, flexible, soft-seam adhesive for bonding closed-cell vinyl foam to itself and to fabric, as well as to phenolic and other plastics, to metal, wood, composition board and other rigid, semi-rigid and flexible materials. The synthetic rubber-resin adhesive is designed to withstand the solvent attack of the vinyl marine coatings commonly applied to these foams. According to the manufacturer it may be brushed, roll coated, or sprayed with conventional equipment to provide bonds which feature superior resistance to: salt water and high humidity conditions; fatigue and vibration; hot oil, gasoline, aromatic fuels and organic solvents; and prolonged exposure to temperatures up to 250° to 350°F. *Rubber & Asbestos Corp.* **P-418**

Liquid Epoxy Insulation

A new, high voltage performance, two component, liquid epoxy insulation system has been designed to produce void-free impregnation of fine wire, inter-leaved, high voltage coils. It is also used as the compatible encapsulating casting material. According to its maker, in addition to its outstanding electrical properties, it is resistant to thermal and mechanical shock and is economical to use. Moreover, it was specifically developed to meet the requirements of MIL-I-16923C, Types B, C, and D. *Hysol Corporation.* **P-419**

Epoxy Protective Resin

Scotchkote brand Protective Resin No. 101, a one-part powdered 100 per cent epoxy resin, is said to provide easily applied epoxy corrosion protection for pipe fittings, supports



and other related objects. The product can be used to apply corrosion protection to fittings prior to their arrival in the field. Sprayed on heated parts with a flocking gun, the resin flows evenly to give a uniform, smooth coating which cures in less than 60 seconds. When cured it is completely thermoset and will not flow upon heating. It has an adhesion strength of more than 3,000 psi, high impact resistance, and resists attack by most chemicals, the company reports. *Minnesota Mining and Manufacturing Co.* **P-420**

Two-Part Adhesive

Armstrong J1158 is a two-part adhesive packaged in a small saran tube, which is said to give a resilient bond at −40° to 185° F. Originally developed for bonding replacement mirrors to automobile windshields, its manufacturer also expects it to have a wide application wherever a strong, flexible chemical setting type adhesive is needed. The product has good tenacity and flexibility in holding materials such as metal-to-glass, metal-to-metal, plastic-to-glass, rubber-to-metal, etc. It cures at room temperature, but the cure can be accelerated through use of a heat lamp or by immersing the tube into hot water after mixing. The adhesive is packaged in a small saran tube which contains both the base material and the catalyst. *Armstrong Cork Co.* **P-421**

FOR MORE INFORMATION on these new products use the Readers Service Card in this issue.

Epoxy Adhesives Kits

Three new epoxy adhesives kits, recommended by their manufacturer as room temperature curing materials, are being marketed. The two component kits of epoxy and hardener provide an adhesive mix that thickens and jells in four hours and hardens in 24 to 48 hours at room temperature. Curing time is shortened at higher temperatures. The kits are supplied with: one pound of epoxy and one half pound of hardener, one quart of epoxy and one pint of hardener, and one gallon of epoxy and one half gallon of hardener. *Schwartz Chemical Co.* **P-422**

Synthetic Rubber Adhesive

A translucent, amber-colored adhesive, Rez-N-Glue 164 retains its tackiness for several hours, permitting delayed assembly of trim fabric, insulation and similar materials to metals or fiberboard. Based on synthetic rubber, the adhesive is said to be particularly useful for single surface application and temporary process bonding. Application is by brush coating clean surface of both sections. Bonds form quickly and are resistant to heat and cold and water, states the manufacturer. *Schwartz Chemical Co.* **P-423**

Contact Cement

Bestwood Contact Cement is designed to offer faster quality bonding of decorative laminates to wood, metal, and composition board. According to its manufacturer, the product offers ease of application, greater mileage, high initial bond strength and high resistance to heat. It is also offered as a general purpose adhesive. The cement comes in pints, quarts, gallons, five gallon cans, and 55 gallon drums. *Hardboard Fabricators Corp.* **P-424**

Pourable Cement

A finely divided powder, Erv-Tite contains expansion controlling, water-erosion resistant additives. The pourable cement can be used for positioning and setting anchor bolts, fastening pipe flanges, hand rails, stanchions, conveyors, stadium seats and furnaces. It is said to provide a hard, tough base in a few hours. The anchoring compound is self-leveling, vibration resistant and non-shrinking while setting. *Monroe Co., Inc.* **P-425**

New Gelva Emulsion TS-100 . . .

for outstanding performance in all laminating adhesives

Now you can solve your laminating adhesive problems with GELVA Emulsion TS-100, a new vinyl acetate—acrylate copolymer emulsion. The emulsion provides exceptional adhesion to smooth, non-porous surfaces such as glass, aluminum, Mylar and polyvinyl chloride. Emulsion films are clear, relatively soft, non-re-emulsifiable and have excellent low temperature flexibility. Importantly, GELVA Emulsion TS-100 has . . .

- unexcelled adhesion to smooth, non-porous surfaces
- excellent compatibility with borax and organic solvents
- good water resistance

In many applications, GELVA Emulsion TS-100 requires only minor compounding to develop maximum performance. In addition, the unique chemical composition of the emulsion makes possible a degree of tackiness . . . wet grab, legs . . . unusual in polyvinyl acetate based emulsions.

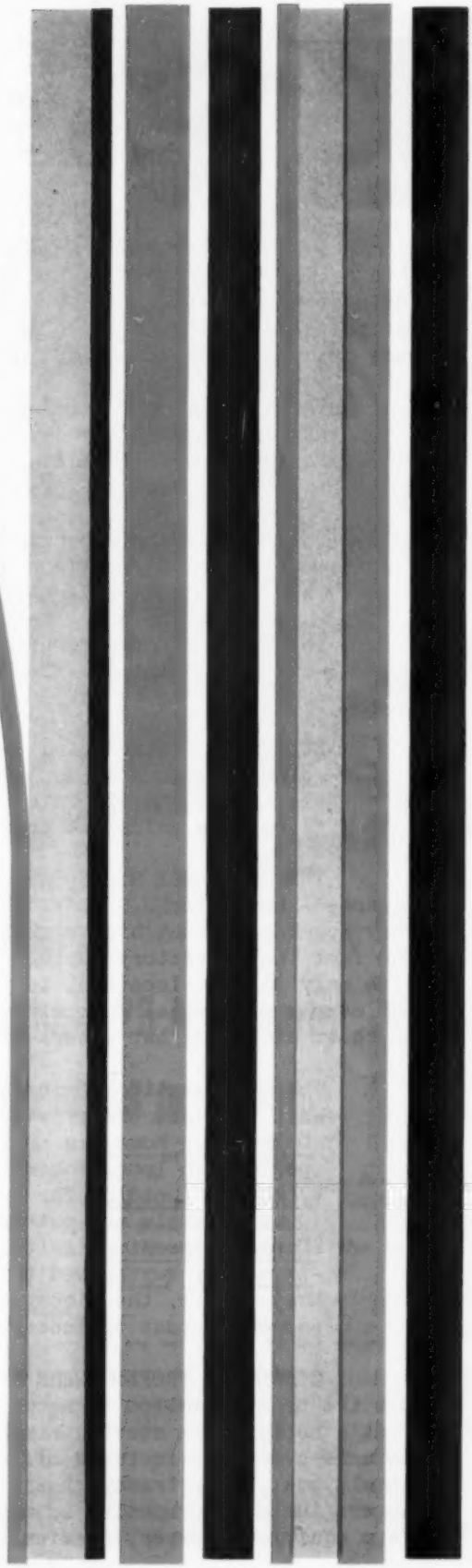
GELVA Emulsion TS-100 is chemically unique . . . it is the only copolymer of its type commercially available. For a generous trial quantity please write Shawinigan Resins Corporation, Department 93, Springfield 1, Massachusetts.

SALES OFFICES: ATLANTA CHICAGO LOS ANGELES NEW YORK CLEVELAND SAN FRANCISCO GREENSBORO ST. LOUIS

GELVA®, GELVATOL®, BUTVAR® and FORMVAR®

emulsions and resins for adhesives

SHAWINIGAN RESINS



capitol cues

A PROGRAM TO FIGHT A RECESSION is now taking shape in Washington. This doesn't mean top officials believe that we are heading for trouble. The Administration's line is still: "The business readjustment is nearly over." But policy-makers want some insurance, just in case business gets worse. All this is quite a switch from a month ago, when relatively little was being done.

The actions do not add up to a big-spending crash program. Rather, they involve stepped-up federal ordering and loans. Contracts spur the economy long before goods come off the line. The impact is felt as soon as firms start ordering.

Here's what the government has been doing:
- Defense: Contracts for previously-programmed missile and space projects may be increased 5% or more by year-end.
- Highways: The government is releasing hundreds of millions of dollars for superhighway work, well ahead of schedules.
- Reclamation: Allocation of new funds voted by Congress is being rushed by the Interior Department for water projects.

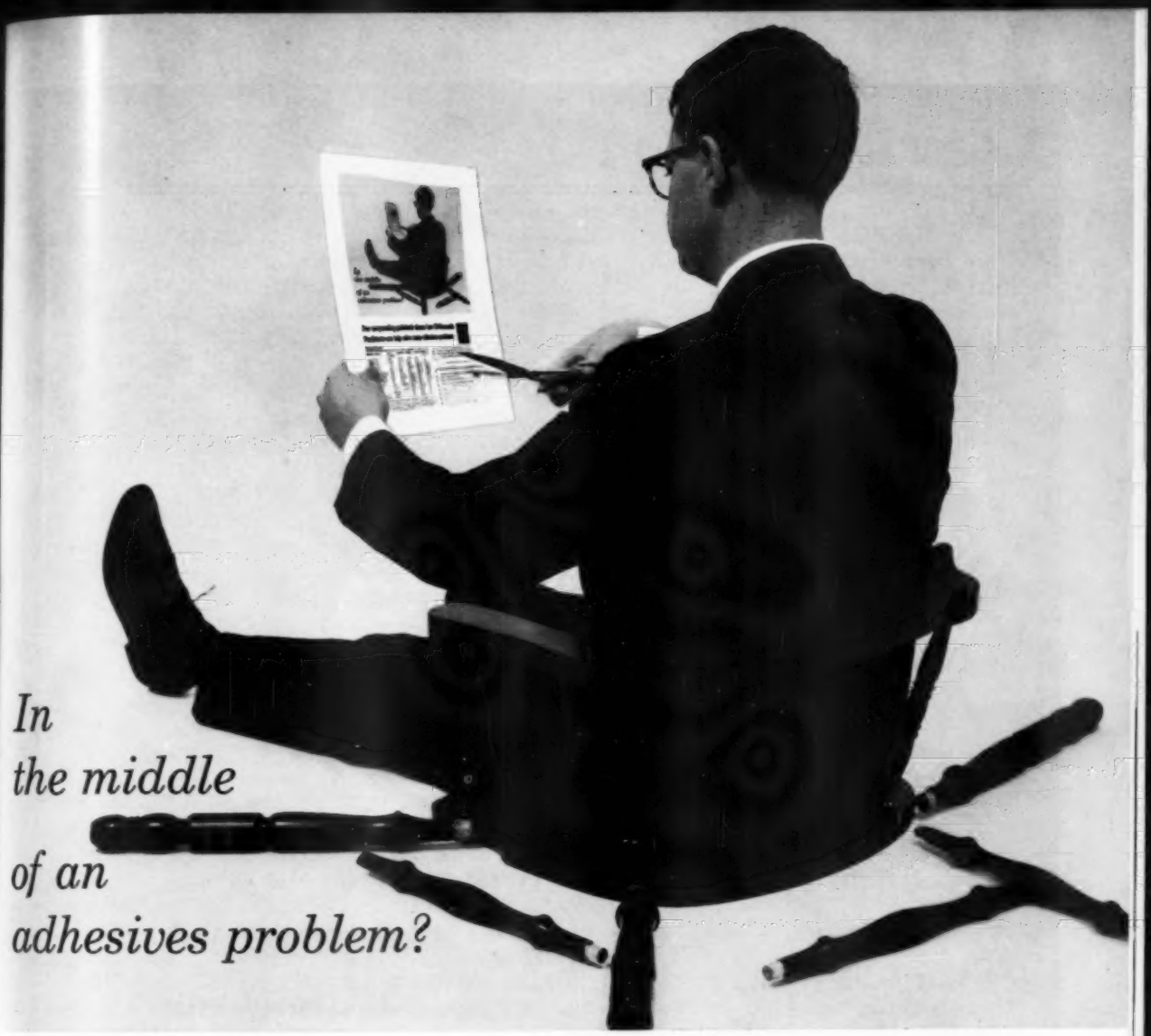
Efforts are also being made to stimulate housing, which is going through a slump. The government is making money more plentiful, shaving interest rates slightly. And the U.S. is raising prices it pays for GI and FHA-insured mortgages.

WHETHER THESE STEPS CAN BLOCK A SLIDE is still a very open question. As noted above, top U.S. officials, including the President, are optimistic. They are happy about high employment and the way inflation has been slowed. The fact that inventory buying dropped from billions to zero in only a year, with only mild dislocation, is taken to mean that the worst is about over. But many professional economists see a recession; a majority think it will be short and mild, but others among the experts are gloomy about prospects.

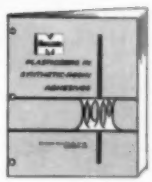
The pessimistic experts see no guarantee of a short decline. Why? Because the private sector just doesn't have much bounce.
- Demand for homes is no longer pressing. And with repayment periods so long, lower interest rates won't cut payments much.
- Consumer spending for autos, appliances, and furniture won't jump. People are putting more into education and services.
- Capital spending isn't likely to zoom, with so much capacity.
- Inventory buying won't rise much, with sales so sluggish.

Most of all, the gloomy economists fear that a long slide will snowball--that business will retrench and layoffs will spread.

CORPORATE PROFITS WERE UP ABOUT 10% in the third quarter over 1959. But the true situation is actually somewhat poorer than this figure shows. That's because the steel strike had already pulled earnings down last year. Gainers over 1959 included office equipment, nonferrous metals, railroads, steel, coal, oil, transport equipment, finance, food, beverages, tobacco. Losers included companies in machinery and the producers of such things as farm equipment, paper, chemicals, and textiles. Many drops were sizable.



New compounding guidebook shows how 25 Monsanto Plasticizers can help solve many adhesives problems



EXAMPLE:

Monsanto plasticizers help tailor PVAc emulsion properties to specific needs

Monsanto Plasticizer	Heat Sealability	Quick Tack	Flexibility	Performance	Relative Cost
AROCLOR 1211	Good	Excellent	Excellent	Good	Low
AROCLOR 1232	Good	Excellent	Good	Good	Low
AROCLOR 1242	Good	Good	Good	Good	Low
SANTICIZER 140	Good	Good	Good	Excellent	Medium
SANTICIZER 141	Good	Good	Excellent	Excellent	Medium
SANTICIZER 160	Good	Good	Good	Good	Medium
TRICRESYL PHOSPHATE	Good	Good	Good	Excellent	Medium
DIMETHYL PHTHALATE	Good	Excellent	Excellent	Good	Medium
DIETHYL PHTHALATE	Good	Excellent	Excellent	Good	Medium
DIBUTYL PHTHALATE	Good	Good	Excellent	Good	Medium
SANTICIZER B-16	Good	Good	Excellent	Good	High
SANTICIZER M-17	Good	Excellent	Good	Good	High
SANTICIZER 1-H	Excellent		Good	Excellent	High
SANTICIZER 8	Good	Excellent	Good	Good	High
SANTICIZER 9	Excellent		Good	Good	High
DIPHENYL PHTHALATE	Excellent		Good	Good	High
TRIPHENYL PHOSPHATE	Excellent		Good	Excellent	High

FOR EVERY TYPE of synthetic-resin adhesive . . . *emulsion, hot-melt, delayed tack, solution, pressure-sensitive, nontoxic* . . . Monsanto gives compounders the widest choice of quality plasticizers available anywhere. Just state your specifications . . . Monsanto can provide a plasticizer system to meet your compounding needs *exactly*.

"*Monsanto Plasticizers in Synthetic-Resin Adhesives*," new Technical Bulletin PL-307, contains up-to-date plasticizer performance data . . . *plus* detailed discussion of 51 specific adhesive formulas. Send for your copy, *today*.

Aroclor, Santicizer: Monsanto T.M.'s, Reg. U. S. Pat. Off.

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
Dept. 2715, St. Louis 66, Mo.

Monsanto

Please send me Technical Bulletin PL-307

Name.....*Title*.....

Company.....

Street.....

City.....*Zone*.....*State*.....

capitol cues (cont'd)

STRIKES WILL BE FEWER IN THE COMING YEAR, say Labor Department experts. They base this on two things. One is softening business, which makes workers unwilling to risk jobs. The other is the General Electric contract--a union set-back; this is likely to put a damper on future strikes in other industries. Leaders won't be in a hurry to pull their men out after the GE debacle.

> Tougher management stands go far to explain what has been happening in labor disputes. In today's soft economy, it take a hot, clear-cut issue to arouse workers. Big issues next year will be wages and eliminating escalator clauses.

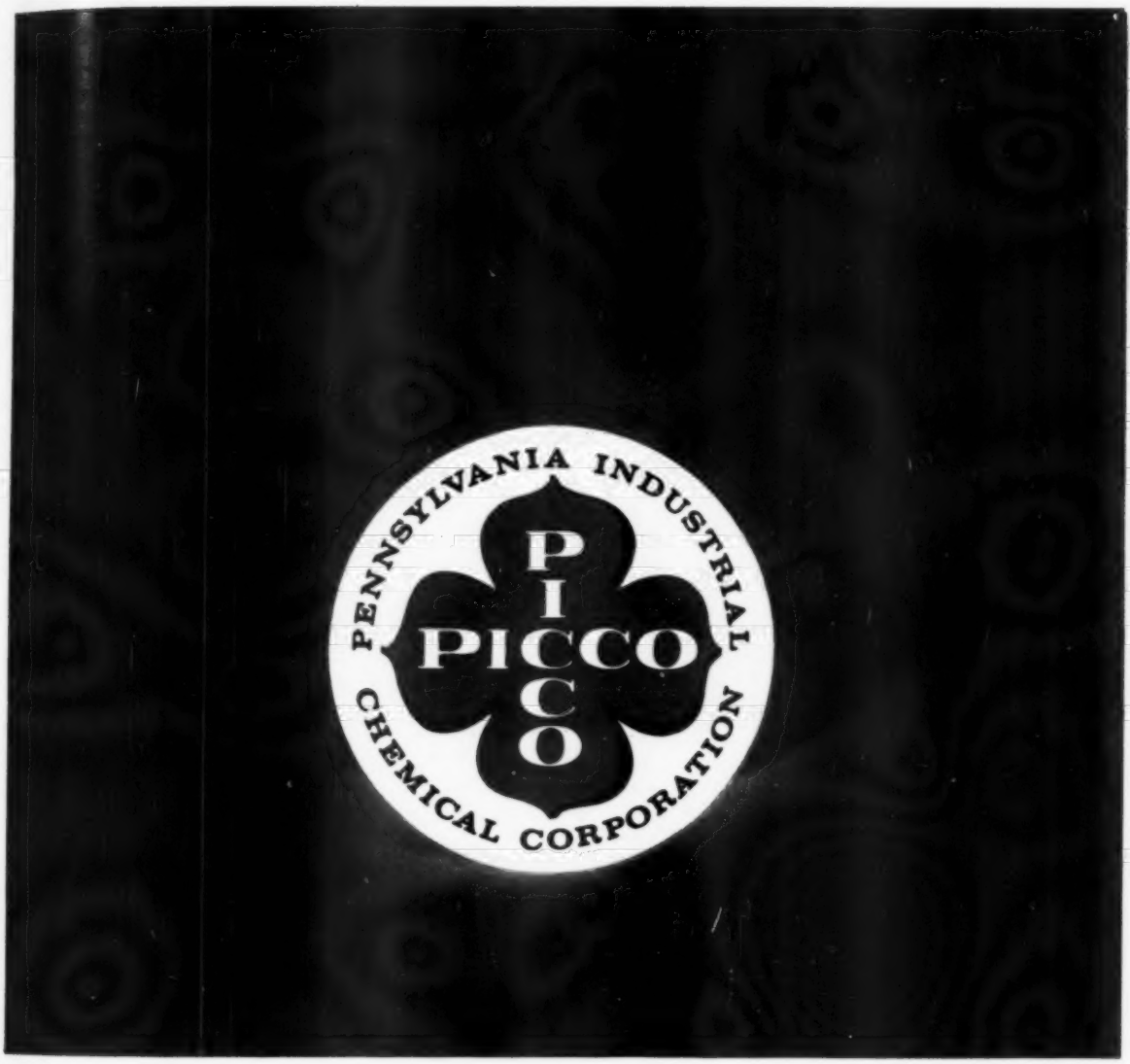
WAGE INCREASES ARE RUNNING A LITTLE LARGER this year than during 1959. For the first nine months, increases centered about a figure of 9.5¢ an hour. By contrast, the comparable figure for the past year was only 8.8¢ per hour. Clauses calling for deferred wage increases appeared in half of the contracts.

> Here's how the over-all figure breaks down:
> -In manufacturing, the central figure came to 8.2¢ an hour.
> -In nonmanufacturing, the median increase was 11.8¢ an hour.
> Labor experts believe the size of the gains will start to decline soon. This usually occurs when business slows down.

EQUITY-CAPITAL LOAN FUNDS FOR SMALL FIRMS will be expanded in the next six months. The lending potential of the Small Business Investment companies will double; the loan pool will go up to around $500 million. The number of SBIC's with licenses to operate will exceed 300 by mid-year, compared with a total of less than 200 at the present. The amount of funds will be swelled by U.S. loans and by stock sales as well as the investment of incorporators.

WORK ON 1961 LEGISLATION HAS ALREADY BEGUN in Washington, now that the election campaign is out of the way. House and Senate Committee staffs --and reelected lawmakers--are working on many issues that concern business. Among them are bills that failed to pass during the 1959-1960 session.

> Here's a quick look at what might happen on some key issues:
> -On defense spending, the Presidential debate over the strength of the nation assures an extra $1 or $2 billion in spending.
> -On labor, Congress will vote an increase in minimum wages; additional coverage, too, will be approved. The unions will ask a U.S. ban on state right-to-work laws. It won't pass.
> -On antitrust, prior government approval for the big mergers will be authorized. A national fair trade law may be passed.
> -On tariffs, Congress will vote another extension of the law for negotiating reciprocal trade agreements. This shapes up as one of the hottest fights in Congress, though. Advocates of high tariffs and quotas will be stronger next year and will get quotas on some items--oil, lead, and zinc, for instance.
> -On drugs, Congress probably will require producers to get prior government approval on the safety of their products. The government also will receive more power to check plants.
> -On depressed areas, a big assistance program will be voted.
> -On pollution, more federal funds will go to municipalities.
> -On education, the federal aid program will be expanded. But, it is doubtful whether funds will go to lift teachers' pay.



Designed for confidence

Picco Resins

You can specify Picco Resins with absolute confidence in the high quality of these fine hydrocarbon products. Carefully manufactured under rigidly controlled conditions in large quantities, their consistent uniformity assures trouble-free operation. Picco Resins are neutral thermoplastics, and are resistant to alkalies, salts and dilute acids. Their wide spectrum of utility is accentuated by stability and inertness.

The trademark of quality

PENNSYLVANIA INDUSTRIAL CHEMICAL CORPORATION
CLAIRTON, PENNSYLVANIA

Distributed to the Rubber Industry by HARWICK STANDARD CHEMICAL CO., Akron 5, Ohio

• **German Labor Shortage,** P. Beiersdorf & Co. A.G., Hamburg, one of the best known companies in the cosmetic field, diversified and built a factory for adhesives a few years ago. Due to the success of its adhesives line, the company contemplates buying an additional factory, located in Offenburg (Baden) in the southern part of Germany. Sales of adhesives have progressed very nicely in West Germany and foreign demands for the products of the company have increased rapidly. However, in view of the shortage of labor the expansion will be limited and many chances of additional business will not be fully utilized.

• **Movable Impact Adhesive.** Contact or impact adhesives have become exceedingly important in industry —particularly in the building industry. Their great importance is based on the fact that they enable the bonding together of a wide variety of materials by mere contact and without pressure. There are, however, serious disadvantages—among them the fact that all work has to be accurately positioned, as adhesion takes place in three dimensions. A technique has been developed which, it is claimed, gives an instantaneous right angle bond on contact, yet allows complete freedom of movement in the plane. This means that there is ample time for moving the object into its correct position, although it cannot be removed from the surface. No solvents are used, and the material is free running and clean to use. The bond is said to be far stronger than that of traditional contact resins.

• **Polyester Resin Bonding.** Applicability and compounding of polyester resins is the theme of an editorial in the September issue of *Plaste und Kautschuk* published in East Germany. The author states that several unsaturated polyester resins are applicable as cold setting adhesives for metal. Setting is obtained by an oxido-reduction system (dimethyl aniline/benzoyl peroxide). Dry benzoyl peroxide yields higher strengths than benzoyl peroxide paste (effect of plasticizer in the paste.) Bonding strength is also increased by adding fillers. Benzoyl peroxide (BPO) can be distributed in the filler and the mixture added to the resin. The simultaneous addition of an accelerator is important for the user. However, the setting time of the mixture must not be increased too much. It was found that the setting time was reduced by adding dark ground slate or metal powders and that in the latter case it can be dispensed with accelerators. Thus compounding of a two-component adhesive is possible.

• **New Du Pont Resin Factory in Holland.** A factory processing delrin acetal resin will be built by E. I. du Pont de Nemours (Netherlands) at Dordrecht (Holland). Construction of the plant will start immediately and production is scheduled to begin in 1962. The resin will be marketed in Western Europe.

• **Interest Expressed in Export Promotion.** The Commerce Department plans to ask Congress next year for about $1.2 million to keep its export drive going. This is twice the amount which was used in the current year. It is estimated that about 12,000 American companies—mainly large ones—are now exporting. The officials of the Commerce Department believe that perhaps five times that many could be selling abroad if convinced of the possibilities.

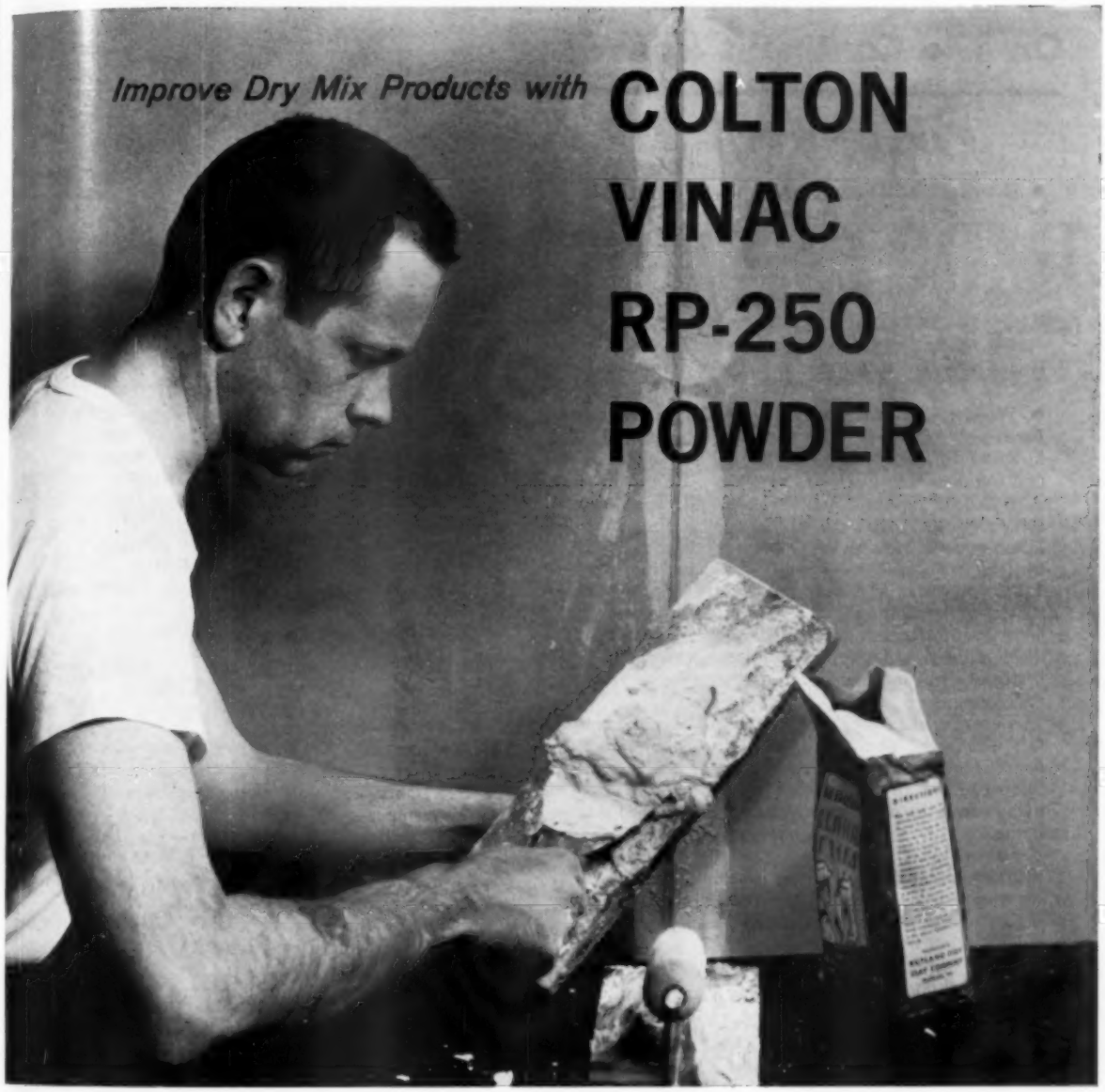
Recently, the Commerce Department invited the Maritime Industry to a discussion of export promotion possibilities. The invitation went out to about 20 representatives of steamship lines, labor and maritime organizations. To the astonishment of Commerce officials, more than 60 persons showed up, jamming the meeting room so that the doors could not be closed as planned to keep the meeting private.

Obviously, our Commerce Department has finally learned to use promotional efforts to stimulate export drives. The adhesives and related industries would certainly react as favorably to a similar invitation and might surprise the department by a very large attendance.

• **First Scandinavian Synthetic Resins Plant.** The region's first synthetic resin plant is now under construction at Lilla Edet, Sweden. It is being built by A/B Hercules, a subsidiary of the Hercules Powder Co. The plant is expected to be on stream early in 1962.

• **French Imports and Consumption of Industrial Adhesives.** According to official statistics published a short while ago, France imported 690 tons of industrial adhesives during 1958. At the same time it consumed 12,635 tons, so that imports covered approximately 5.5 per cent of the domestic production. Most of the industrial adhesives had been supplied by the United States, Great Britain and Germany. We supplied about 50 per cent, and Germany and England supplied the balance.

• **On "Polyvinyl Chloride Plastisols."** After defining the rheological properties of plastisols, the author of this feature article published in the French magazine *Revue Generale Du Caoutchouc,* shows how to modify them in practice, to quickly improve a paste for a given use. The aim is to achieve a paste which does not permeate through fabrics, is sufficiently fluid despite a low plasticizer ratio, does not settle its fillers, has a good shelf life, is rather viscous despite plasticizing, and does not tend to run between coating and jelling. Further aims are the production of non-tacky plastisol end-products, and high abrasion strength coatings.



FOR EXCELLENT ADHESION, LESS SHRINKAGE AND LOW WATER DEMAND, FORMULATE YOUR DRY MIX PRODUCTS WITH THIS SPRAY DRIED REDISPERSIBLE PVAc.

Dry concrete ready-mixes, spackling compounds, powder paints and joint cements for dry wall construction are easier to use and give better end results when formulated with Colton Vinac RP-250 Powder.

Vinac RP-250 Powder, a spray dried redispersible polyvinyl acetate, is a superior, economical binder for commercial fillers. Concentration may be as low as 7 parts to 90 or 100 parts of filler.

Imparting excellent adhesion to dry mix products, Vinac RP-250 Powder cuts the "soaking" period of casein-type cements by half, has lower water demand and, therefore, less shrinkage, and is easier to formulate.

Samples and technical bulletin available on request.

COLTON CHEMICAL COMPANY

A Division of Air Reduction Company, Incorporated • 1747 Chester Avenue, Cleveland 14, Ohio
Sales Offices and Warehouse Facilities Throughout U.S. • Export: Airco Company, International, New York 17, N.Y.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .

AIR REDUCTION PRODUCT

On The Continent (cont'd)

• **German Mail Order Association.** This organization sells approximately a billion dollars worth of goods, produced by over 3,000 members in West Germany, every year. The German public is looking for more goods of better quality and wider variety. Every manufacturer of our industry producing consumer goods is invited to mail his catalogues and price lists to the Bundesverband des Deutschen Versandhandels e.V., 16 Erlenstrasse, Frankfurt am Main, West Germany.

• **Woodworking Industries Require Large Amounts of Improved Adhesives.** The next Carinthian Trade Fair in Klagenfurt, Austria, will be mainly devoted to lumber and woodworking industries as was the 1960 exhibition. Also called the Austrian Wood Fair, the 1961 event is scheduled for August 10 to 20. The deadline for exhibition space is May 31.

Held August 11 to 21, the 1960 exposition attracted 1,046 industrial and farm products exhibitors. Yugoslavia, with 81 firms, had the largest representation among 106 foreign participants Six U.S. companies displayed air conditioning equipment, chain saws, fork lift trucks, related machinery and many chemicals and adhesives.

Klagenfurt is a very lovely resort town and the trade fair will be an excellent opportunity to combine business with pleasure. American firms exhibiting at the fair will have an opportunity to establish contacts with many countries, not only in Western and Central Europe, but also with South-Eastern countries, the Middle and Far East. In all probability, many visitors from Africa will also look over the newest developments. The Trade Development Division, Bureau of Foreign Commerce, U.S. Department of Commerce, Washington 25, D.C., will supply further details.

• **$23,000,000 Loan For Yugoslav Plastics and Chemical Plant.** A loan for establishing a plastics and chemical plant near Zagreb has been granted by the Development Loan Fund. The factory will consist of eight processing units which will produce polyethylene, styrene, polystyrene, phenol and acetone, using locally produced liquefied petroleum gas as the principal raw material. Hitherto the inability to procure enough plastics and related chemicals, due to Yugoslavia's shortage of foreign exchange, has retarded the development of many processing and other light industries. Some of the chemicals will be used in the manufacture of such products as housewares, pipes, dyes, resins, adhesives, paints, herbicides, films and many other related types of products.

• **New Business Possibilities in India.** The National Small Industries Corporation, Ltd., a government concern with offices at 5-E Rani Jhansi Road, New Delhi, India, has just received a $10,000,000 loan from the U. S. Development Loan Fund. It will be used for procuring equipment which will be made available to small business in India on a rental-purchase plan.

Estimates indicate that small industries in India curretly employ about 50 million persons, five times as many as are employed in larger industries. Such industries are believed to be able to absorb 20 million dollars worth of new machinery and equipment each year. Their encouragement is expected to help create a broad base for the Indian economy and to provide additional employment both in the industries themselves and in the production of raw materials.

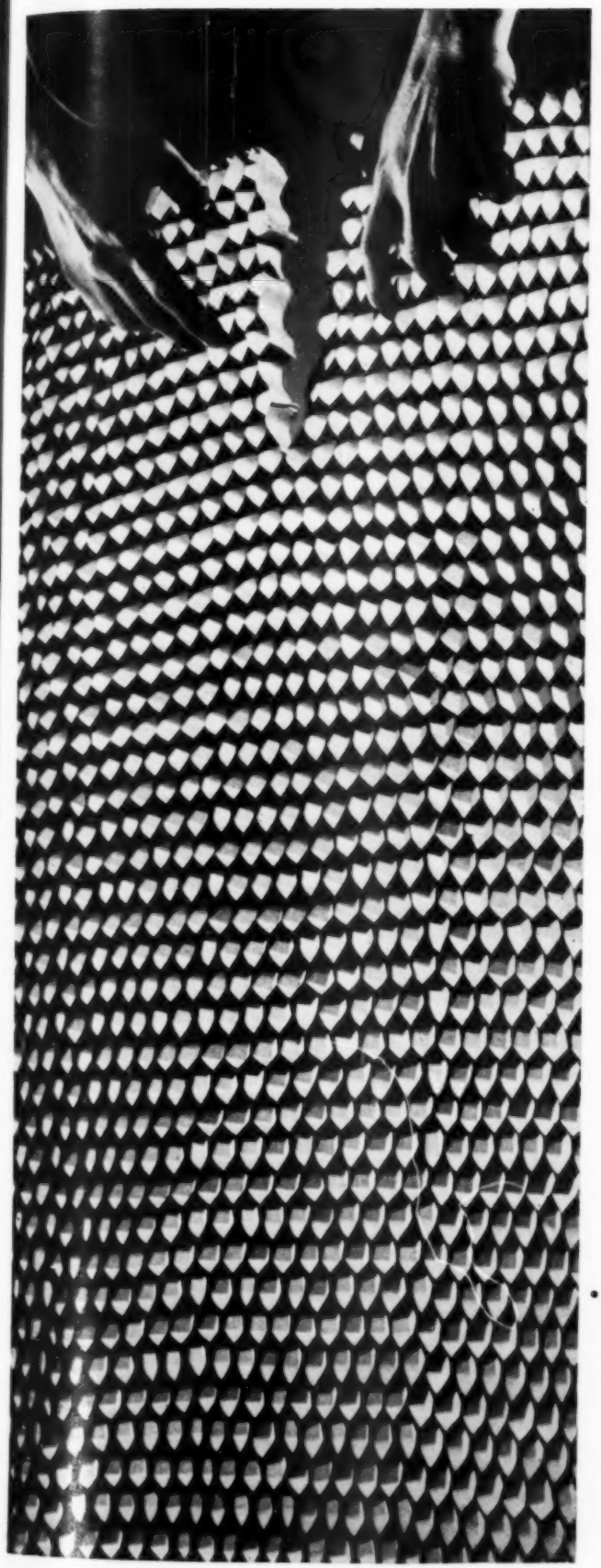
Terms of the D.L.F. Loan

Under the terms of the D.L.F. loan, the money can be used to meet foreign exchange costs of capital equipment and related materials and services made available through rental-purchase agreements to private borrowers. It is expected to stimulate projects which will contribute to the basic economic development of India. Among the industries which have received machines and equipment through NSIC in the past are firms producing hardware, agricultural implements, clocks, tiles, bricks, paints, varnishes, chemicals of all kinds, plastics, adhesives, insecticides, fungicides and many other related products. Amercan companies interested in extending their trade with India are encouraged to communicate with the New Delhi office of the N.S.I.C., Limited.

• **The Language Barrier.** Do you understand the following press release of the State Department, published on September 28? "Aviation delegations representing the Governments of Denmark, Norway and Sweden on the one hand and the Government of the United States on the other, met in Copenhagen for consultations during the period September 12 through September 28, 1960. These consultations were held on United States initiative for the purpose of resolving certain basic differences in interpretation and application of the capacity provisions of the Air Transport Agreements between the United States and the three Scandinavian countries. It became clear during the course of the discussions that the views held by the respective delegations on the capacity provisions of the Agreements differed considerably. The consultations have been conducted in the friendly atmosphere that has traditionally characterized the relations between the Scandinavian countries and the United States in the field of civil aviation. The delegations will now report to their respective Governments."

Need for Plain Language

Translated into plain language, the State Department wanted to inform the press that American Airlines, concerned by the increasing volume of Scandinavian air traffic between the United States and Scandinavia, have asked the State Department to intervene in order to curtail the traffic volume carried by the Scandinavian airlines. It seems that the State Department is still obsessed by the idea that the American people cannot take blunt facts; efforts like these were used about 160 years ago. Nowadays a bolder, more direct and plainer language is appropriate; this would do much more for America than the feeble imitation of a diplomatic language which faded away scores of years ago.



Schenectady Phenolic Resins Add Permanence and Strength to

PAPER HONEYCOMB ADHESIVES

In natural, nitrile or neoprene-based industrial adhesives, Schenectady modified phenolic resins increase adhesion, improve aging, heat, and moisture resistance — important features for stronger, longer lasting paper honeycombs. Note how the paper tears before bond failure in the illustration at left.

Schenectady Varnish manufactures a complete line of resins for adhesives. Phenolics, modified-phenolics, terpenes and terpene phenols all are commercially available for use in pressure-sensitive. shoe sole and industrial adhesives. Whatever your adhesive resin requirement, your Schenectady technical representative is ready to help. Why not call him today or write; Schenectady Varnish Company, Inc., Dept. 20, Schenectady, N. Y.

SHOE SOLE ADHESIVES containing Schenectady phenolic resins stand up to hot pavements, have excellent cohesion and adhesion. Tack-free at room temperature toward other materials, they simplify handling, speed production.

• *Resins and Varnishes For Industry — Since 1906*

SCHENECTADY
VARNISH COMPANY, INC.
SCHENECTADY 1, NEW YORK

Plants in Canada, France, Mexico

By G. V. UPTON

Production Manager
Thermogrip Adhesives and Applicators
United Shoe Machinery Corp.
Boston, Mass.

Cord-Like Hot Melts

A new adhesive form and associated machinery are said to make the advantages of hot melts more widely available to general industry

The marriage of chemistry and engineering has begotten a hot melt adhesive system capable of offering users the inherent advantages of hot melts without the commonly associated drawbacks. Chemistry's major role was that of evolving the adhesive in the radically new form of a cord, and engineering's was that of designing machinery for effectively applying the adhesive and melting and metering it at the same time.

All adhesives must pass through a liquid or fluid stage and then become solid in order to obtain cohesion. This transition may be by solvent release, by chemical reaction or in the case of hot melt adhesives, by cooling. The last is the fastest acting.

What transpires is that at the point where the hot melt adhesive contacts the surface of the material to be bonded, the material attains a temperature almost equal to that of the adhesive and a high degree of "wetting" occurs. Cohesive strength is achieved, and as the rapid cooling takes place, nearly instantaneous bonding results.

In addition, hot melt adhesives enjoy another important advantage. They can effect excellent bonds to hard-to-stick materials, such as high-finish papers, polyethylene films, polyethylene - coated paper and board, wax-coated paper and board, aluminum foil and fabrics. This is because they are at elevated temperatures when applied and depending on the melting point of the materials to be bonded, a degree of fusion or softening of the material occurs.

Another advantage of hot melts is the excellent resistance they provide to such destructive foes of adhesion as water, oxidation, flexing, elongation, acids, alkalis, oils, fats and salts.

Hot melts are produced in many formulations, each with its particular strength and performance characteristics. A formulation can be tailored to contain a high degree of resistance to shear, peel, impact or fatigue failure, as desired. It is the availability of many different raw materials, each able to contribute its own particular adhesive properties, which is primarily responsible for this range of characteristics. Some of these materials, now being used in increasing quantities, are polystyrene, polyamides, polyethylene and other thermoplastic high polymer resins.

The adhesive chemist has many other ways of varying the specific properties of formulations. He can mix higher and lower molecular weight polymers of any one of these or of two or more together; he can add plasticizers and various modifying agents, and he can include reinforcing fillers or pigments.

An additional advantage of hot melt adhesives it that because they are free of solvents, there are no volatile components to create hazards of fire and toxicity. For the same reason, the adhesive can be stored for long periods without deterioration. Waste, in comparison to other types of adhesives, is very little.

The advantages of hot melt adhesives, however, have been negated to a degree by the inadequacies of associated machinery and equipment for applying them to the materials to be bonded.

Whether their original form was slabs, cakes, granules or pellets, hot melt adhesives have had to be placed in melting reservoirs and heated for long periods before use. This, in turn, made it essential to provide means of controlling heat because the adhesives would char at high temperatures or set prematurely at low temperatures. Besides, in melt pots a considerable quantity from one pound to several pounds of adhesive must be kept above the fusion temperature for long periods. When fresh solid must be added to replenish supply, the problem of controlling temperature accurately becomes difficult.

Various types of preheating equipment were devised in an effort to eliminate the shortcomings of melt pots. The objective was to bring the adhesive to the applying chamber at exactly the proper temperature. But even the simplest preheating unit is costly—and space-consuming.

Even when satisfactory means of bringing the adhesive to the liqbid or molten stage were available, the applicating machines or units were unable to insure the full benefits of hot melt adhesives to the users. Too often, the potentials of the hot melt adhesives for providing substantial production-line advantages were not even approximately realized.

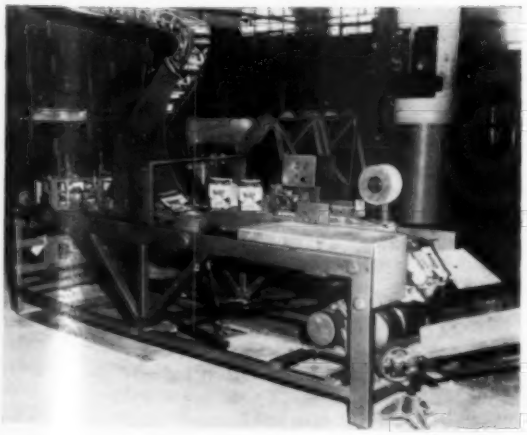
To be sure, doctored rolls have been used with some success. But this method is handicapped by all of

Applying tape to the ends of multiwall bags with cord-like hot melts and special applicators, photo far left, at Virginia Pulp and Paper Co. plant. The tape protects against moisture and sifting.

In the photo at left, a new reel of cord adhesive is shown being loaded at Bemis Bro. Bag Co. plant in East Pepperell, Mass. The company was among the first to adopt the new adhesive bonding technique.

Howard Towell, plant superintendent at Rotary Manifold Forms, shows some of the continuous multiple-part business forms being produced with the Thermogrip adhesive system. By adopting the technique, Rotary eliminated production bottlenecks caused by slow drying adhesives. Note five reels of cord adhesives mounted over production line.

This equipment for closing multi-pack cartons has a comparatively short compression section because it was designed to take advantage of the cord-like hot melt adhesive system.



The Thermogrip system speeds the closing of cigarette cartons. Because of the controlled minimum application pattern, the cartons can be easily opened to affix state tax stamps.

About the Author . .

GEORGE V. UPTON has been associated with the joint United Shoe Machinery Corp.—B.B. Chemical Co. program on cord-like hot melts since 1954. A graduate of Yale's School of Engineering, he joined United's Research Division in 1952.

the deficiencies of melt pots because the roll must be employed in conjunction with a trough from which the molten adhesive can be picked up.

Spraying equipment, expensive to buy and maintain, but usable for only certain situations was the solution for some users of hot melt adhesives.

More recently, production of hot melt adhesives as solvent or aqueous solutions or emulsions to be dried and later heat-activated, has caught the fancy of some. This development is a compromise measure. It sacrifices some of the innate setting speed of hot melt adhesives in order to avoid coping with the problem of devising efficient applicating machinery.

Another late development is an extruder to melt and feed the adhesive. This makes it possible to control both the feeding and heating. However, the adhesive forms used still are pellets or granules, imposing many of the same restrictions associated with melt pots.

In the background of this whole situation and to be considered a basic cause for the slow pace at which efficient applying machinery has been developed, is the lack of a single source for both adhesives and machinery. This has had unfortunate effects in two directions. First, the users found it almost impossible to pinpoint responsibilities for failures when they occurred and this increased their reluctance to continue the use of hot melt adhesives. Second, few individuals concerned themselves with the whole problem, the systems concept.

Adhesive makers worked in a vacuum, so to speak. They continued to introduce newer and better hot melt adhesives with little concern for providing better methods of adhesive application.

United Shoe Machinery Corp. and its subsidiary, the B. B. Chemical Co., have had keen interest in hot melt adhesives for over two decades. Primarily, this interest stemmed from a desire to help speed up and to simplify certain shoe manufacturing operations.

After World War II, an extensive research program was resumed, aimed at developing one or more improved hot melt adhesive systems for use by the shoe industry. Before this research was very far along, it was apparent that the so-called "cord" approach offered the best possibilities. This approach consisted of a hot melt adhesive in a cord-like and flexible form and machinery with which to meter, melt, and apply it.

The primary reason for settling on the "cord" approach was that it promised to achieve complete control of adhesive operations, something no other type of known or contemplated adhesive system could do. As it was finally developed, the "cord" approach allowed adhesives users to control both the rate and the degree of adhesive flow. In addition, it eliminated the use of messy glue pots and lent itself to ease of shipment and storage.

Perfected in 1951

In 1951 United perfected its Thermogrip hot melt adhesive system for use in a shoe operation known as "folding." The job that it accomplished was the cementing and folding of the margins of shoe parts in one instantaneous step. Formerly, leather edges were first rubber cemented, frequently by hand, then in a separate operation folded over and machine pounded. This success led United to seek other applications for its cord adhesives.

Using the cord-like form of adhesive as a measurable element of the system, it was possible to engineer a machine for metering, melting, and applying the adhesive efficiently. The machinery consists primarily of a melting body into which the adhesive is fed at a precise rate and a unique heat transfer system in the body which makes it possible to reduce the adhesive to a molten state at the exact predetermined speed desirable.

To this basic unit, other elements are added. These include extrusion nozzles or wheels—both of many designs—for applying the adhesive to the work and valving and switching components. In the use of extrusion nozzles, the cord/feed rate and the cord cross-sectional area dimension remain the output controlling factors. Thus, it is possible to determine in advance of use the number of grams of adhesive which will be applied per selected unit of length for each adhesive formulation in each model of applicator.

Where the required adhesive seam is to be continuous, the nozzle-type is used; where the adhesive must be delivered to intermittent work, the wheel-type is used.

Variations in adhesive melting and output capacity in wheel patterns and in nozzle patterns are available. The compact units are designed to fit many different converting machines, and can be mounted vertically, horizontally, upside-down or at any angle desired for most effective location of adhesive application.

The first successful use of the Thermogrip adhesive system outside of the shoe industry took place at the East Pepperell, Mass., plant of Bemis Bro. Bag Co. The system tested here proved itself immediately as a tremendous improvement over former methods of providing a side seam for potato bags and two-ply bags. The quick-set of the hot melt adhesive permitted other operations immediately and speeded up production.

Later, at the same company's plant in Seattle, Washington, the benefits of a hot melt were further demonstrated by successful duplication of the Pepperell experience. Another unit, installed at the same company's plant in Houston, Texas, speeded up production of a single-ply pasted bottom, kraft five-pound flour bag.

Other types of bags side seamed with this hot melt system include bags for powdered or granular materials, vacuum cleaner collector bags, and bags for hygroscopic materials. For the last-named, mostly large multiwall bags whose bottoms and in some cases both ends are sewn, cord-like hot melts are often also used to bond kraft tape over the stitching. This provides excellent moisture resistance, a most desirable quality for packers of chemicals.

The first successful application of Thermogrip applicators for closing cartons was in the cigarette industry. Fastening the side flap of a filled carton of cigarettes was the specific job. The adhesive pattern is a series of dots in the middle of the flap. This pattern is applied from a ½-inch wide applying wheel with cir-

cular holes engraved into it. The application is to only the middle portion of the flap to provide easy opening in tax stamping machines.

Other types of cartons closed with cord-line hot melts include the foil and plain board types and multi-pack cartons. Successful installations have been made on both standard and special cartoning equipment. Here again, the availability of a hot melt system engineered for production use permitted these firms to gain the hot melt benefits of good bonds, fast set allowing higher production speeds, and decreased waste.

More recently, Thermogrip adhesives have been adapted to closing relatively large package units made of corrugated board materials. An example is the wrap-around used to bundle a square of roofing shingles measuring 36 inches long and 12 inches wide.

Industry-Wide Advantages

Although the packaging industry represents large volume and potential for hot melts, opportunities in other industries are equally great.

Starting in 1957, United engineers, working closely with experts of the W. F. Hall Printing Co., adopted the Thermogrip adhesive system for speeding up the overwrapping of large, mail order catalogs at Hall's plant in Chicago. The system was incorporated into existing catalog wrapping machinery at Hall. The quick-setting quality of the adhesive and the design of the adhesive applicator enabled the company to run faster and avoid jam-ups which occurred with liquid adhesives even at slower speeds.

Western Printing and Lithographing Co., the world's largest printer of children's books, has started using Thermogrip adhesives to adhere decorative tape over the backs of its books. This is known as "stripping" in the trade. The hot melt adhesive method proved comparable in costs with the gummed tape previously used for this application. The tape was not entirely satisfactory because of the relatively poor bonds to plastic coated and printed covers and because of frequent repairs that had to be made to books. Hot melt adhesives made surer bonds with a reduction in waste and damage to books in process, provided a better quality product, allowed immediate rough handling and made for a much cleaner operation.

Other adhesive operations in the book-making trade include the production of end papers with a better quality at more than double the previous production rate.

Outstanding success has been achieved with the cord-like hot melts in the production of continuous multiple-part business forms at such companies as Rotary Manifold Forms, Inc., Detroit, Michigan, and Baltimore Business Forms, Inc., Baltimore, Md. In this application, hot melt adhesives have eliminated the use of staples and slower drying liquid adhesives for holding the parts together. The result has been substantially increased production rates and cut unit costs. Quality at the increased production rate remains high because of the elimination of part slippage and business machine jam-ups due to poor registration.

In the building industry, one manufacturer has speeded production of a component in which a continuous paper tape is bonded to a continuous metal strip and cut into eight-foot lengths. Another producer of a building material is assembling screen sections to his base material using the wheel-type applicator.

The benefits that only hot melt adhesives can provide are certain to be utilized by many industries in which assembly operations are involved. Developments are underway to achieve improved melting and applying units. As more and more new manufacturing and assembly equipment is designed to include hot melt adhesive systems, significant production rate gains and decreased costs will be sure to follow.

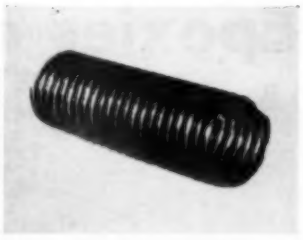
In almost all cases where the cord-like hot melt system has been adopted for use on existing production machinery to replace some other types of assembly method, new highs in production speeds were attained—most often with significant cost-savings. In cases where the system was designed into new equipment, machinery designers invariably were able to reduce machine dimensions because drying sections needed for liquid adhesives were eliminated. Only a meager amount of space is needed in a machine's design to permit the bonding pressure and setting to take place.

That the adhesive manufacturer must and will allocate considerable capital and other resources to the continued development of hot melt adhesives and applicating machinery is obvious. Only from such effort will he be able to make hot melts more available and more usable in new ways to an ever-growing list of industries.

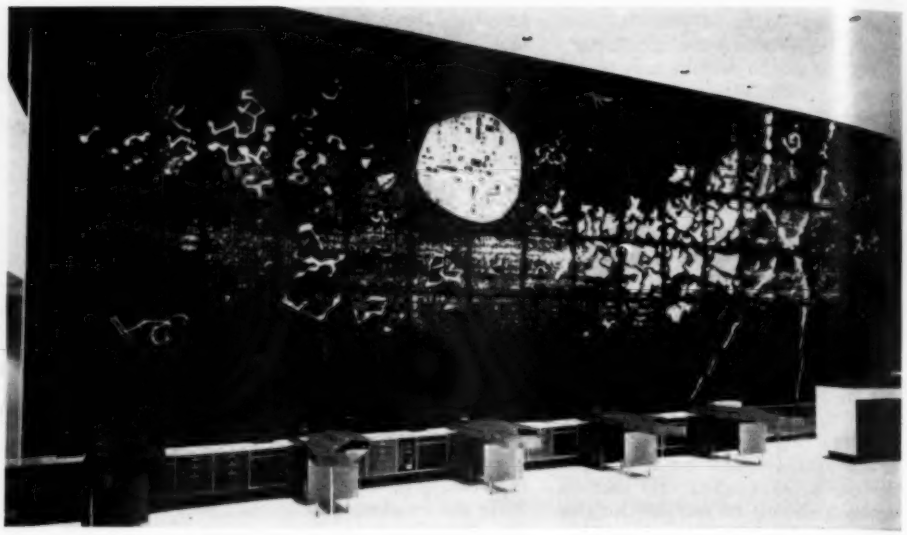
Applications of Cord-Like Hot Melts

The substitution of hot melts for solvent adhesives speeded the side seaming of bags by over 20 per cent.

The Thermogrip adhesive system was used to bond binding tape to vinyl coated covers of children's books.



Auto defroster hose made by using hot melt to bond polyethylene to itself in a continuous spiral.



The color, light and motion of Gyorgy Kepes' "mobile light mosaic" dominate the ground floor window of the KLM building on New York's busy Fifth Avenue.

Epoxies and KLM's Mobile Light Mosaic

Coating and adhesive formulations of epoxies are used to surface panels and bond plate glass to aluminum

By WILFRED LEBRUN
Lawrence Adhesive & Chemical Co.
Lawrence, Mass.

Adhesive formulations based on epoxy resins made an important contribution to the dynamic panorama of light, color and motion that is currently attracting attention to the broad windows of the KLM Building on New York's Fifth Avenue.

Conceived in the spirit of the air age, the KLM mural is intended to convey the feeling of an aerial view of the city's lights and color by night. The "mobile light mosaic" was designed by Gyorgy Kepes, Professor of Visual Design at Massachusetts Institute of Technology.

The effect of the mobile mosaic depends on the use of unchained light functioning through thousands of pieces of colored glass bonded to aluminum panels. To avoid distortion of the light pattern by reflections from the surface, the panels are textured with iron oxide and grit set in a double coat of epoxy.

Designers are extending horizons to more dynamic design for murals. However, realization of such concepts requires new materials, new tools and new techniques. This truth was brought home to us when we sought to construct the KLM mobile mosaic.

Lawrence Adhesive & Chemical Corp. was selected to produce the mobile mosaic. We had, after final approval of the design, only three months to build the mural and install it in the building. This included the time needed for trial and error when problems developed in translating the design into reality.

Because of the size of the mural and the fact that it was to be built in Lawrence, Mass. and transported to New York, it was to be constructed on a modular plan. There were to be 102 modules, each of which would be exactly three feet square. These would be butted together and fastened on a supporting steel framework to show a smooth and unbroken front surface. It was important to avoid interference with design by structural details.

Each module, made of aluminum ⅛" thick, was attached to an aluminum frame by recessed screws. Framed panels were milled on all edges so they would butt together with a tolerance of plus or minus 0.005" overall.

The approved design was transferred to the modular form by means of photographic techniques. Grid lines in accordance with the modular scale were imposed on a photographic enlargement. The enlargement was rephotographed and each section was blown up to fill the three-foot module exactly.

This reproduction, to serve as an individual template for the module, was marked for hole location and cut-outs. Each template was cemented to an aluminum panel to guide drilling and cutting. There are more than 60,000 holes in the mural —ranging from ⅛" to ⅜" in diameter. Modules were coded and numbered to index the place of each in the mural.

Roller coating clear epoxy resin on panel to provide a base for the multi-sized grit.

Grit is sprinkled over tacky epoxy coating to break up any possible reflections.

Panel receives a second coating of epoxy. Black-pigmented formulation is rolled on.

Surface finish and texture were important. Reflections on the surface were not to be tolerated—lest they distort the pattern of light and color contemplated in the design of the mural.

Hot spray metalizing was attempted—but the heat and preparatory sandblasting warped the aluminum panels. Such distortion would be objectionable in the huge plane surface of the mural.

The solution finally adopted was to surface with grit of various sizes. These irregularities would serve to break up transient light falling on the mural. For the finished dull, metallic effect desired, a final coat of iron oxide was applied.

Resists High Temperatures

The grit was set in a coating of epoxy resin. This seemed to be the ideal setting material for it. Epoxy has exceptionally good adhesion properties for metals, and it is not damaged by high temperatures. The lights in the mural were expected to raise the ambient temperature to more than 140°F., so heat resistance was important.

Panels were sanded by machine on both sides after cutting to design to prepare the surfaces for adhesion. Afterward, panels were washed with tuluol, with alcohol, then dried. Workers were not permitted to touch either surface after that lest perspiration and skin oils reduce bonding strength.

Front surfaces were roller-coated with a clear epoxy formulation based on Shell Chemical Company's Epon 828 resin and cured with DMP-30. Both the resin and curing agent were premeasured so that mixing would be simplified. The coating has a pot life of 15 to 20 minutes, which made it desirable to mix in small quantities as used.

Three sizes of grit were sprinkled over the panel surface before the coating dried. Grit sizes were weighed out for each panel before being hand-sprinkled on the surface. The smallest grit, No. 8, determined minimum acceptable coating thickness. The others were Nos. 15 and 20. If the coatings were applied too heavily, the small grit would sink below the surface.

Coated panels were permitted to set at room temperature for two to three hours. By this time, the coating had cured enough to stand panels vertically so that the unbonded grit might be removed.

A second coat of the epoxy formulation was pigmented black—to reduce reflections. Each panel was uniformly roller-coated. The coating was permitted to gel, so that a finger pressed into it did not pull up strings. While the coating was still tacky, the iron oxide was applied over the surface for the desired dull, metallic effect. The finished coating cured overnight at room temperature.

Thousands of pieces of colored glass were bonded into the panels to serve as lenses. To achieve the desired effect, glass of just the right hue and density was cemented over each cut-out. Use of colored glass

Final coating of iron oxide is sprinkled on panel to provide a dull, metallic finish.

Indexed panels are mounted on steel framework. Note fluorescent and tungsten lighting.

proved practicable primarily because of the good adhesive strength of the epoxy resin employed.

Like filling in a jigsaw puzzle, pieces of glass were selected for color and density to work out the design. A panel was placed face-down in a shadow-box of the same size. About half of the glass required for the panel was selected and placed over the cut-outs. Light from the shadow-box permitted visualization of color and design effect.

With glass selected and placed over a large part of the area, the panel was moved carefully to an assembly table. There, workers cemented each piece of glass in place with an epoxy adhesive. The adhesive, Epolac 280, a product of Lawrence Adhesive, is based on a combination of Shell Epon resins. The formulation provides the needed elasticity to compensate for the different coefficients of expansion of glass and aluminum.

Several techniques were studied for cementing the glass to the panels. The method employed is one on which adhesive is used to anchor the glass permanently by means of an overlay technique. The bond strength of the adhesive used in this technique is unusually good. In one case we had to use a power-driven chisel, which merely pulverized the glass. Then we had to use the chisel on the adhesive to remove it from the panel.

Dabs of adhesive were placed on opposite sides of the bottom surface of the glass. Then the dabs were spread over the bottom edges of the glass and brought around to the top edges. In this way there was a layer of adhesive between aluminum and glass, and a "C" curve of adhesive in each glass mount reaching from bottom to top of the glass.

The overlay method is superior to cementing only the bottom surface of the glass. It provides for expansion and contraction of glass, regardless of the size of the piece, on exposure to variations in temperature. There is little possibility of weakening the bond. In two hours the adhesive had cured enough to permit moving the panel. Full cure took place overnight at room temperature.

With half the glass cemented in place on each panel, several panels were placed together to visualize the colors needed for the remaining cut-outs. When glass pieces had all been cemented on all 102 panels, the mural was virtually completed. All that remained was to assemble it for inspection, ship it to New York and assemble it in place.

One six-foot square dominant panel was made by cementing large segments of colored glass to both sides of a sheet of tempered plate glass half an inch thick. Exceptional clarity was called for here, and an adhesive that was not pigmented. The identical epoxy adhesive formulation served for this panel. Light passing through is neither diffused nor dissipated by the adhesive.

The KLM mobile light mural is the successful synchronization of the designer's dream and the technician's reality. A beautiful and colorful gem lighting up the building, the project demonstrates what may be accomplished when the dreamer/designer works in harmony with the realist/technician.

The light one sees in the mural varies constantly in hue, intensity and position. It is not frozen to final design—as would be a painted mural. Such lighting offers constant change, speed and mobility, so characteristic of flying. It recreates the air traveler's experiences when looking down on the metropolis at night. One can see an incredibly rich fabric of light patterns in constant transition. Mobile light was called for in the design to simulate the continually changing mosaics of night as the plane moves across the sky.

Such a mural in competition with the vibrant lights of the sky called for a kind of buffering to maintain intensity regardless of external sources of light. A panorama of mobile and intense light patterns functioning in large dark areas was the answer to this problem. Thousands of mobile dots of intense light and areas of lesser intensity were linked in planned sequence from side to side. This kaleidoscope was immersed in visually insulating dark areas.

Contrapuntal Effect

The KLM mobile mosaic involves something of a contrapuntal effect —as each new light area comes alive and the previous one falls away. Each new color harmony is different from the one before it. A continually changing panorama of light and color is being presented to the viewer. There is a dominant movement—intended to integrate the mobile elements and tie the whole design together. There is a secondary movement—to blend and soften some transitional phases of the dominant movement.

One dominant factor in the mosaic is a six-foot square that is alive with light and color. The square is not mobile—but it is the strongest and richest element of the design—the focus against which all other elements move. As a primary frame of reference, the traveler can relate a man-made cityscape to his background of cosmic richness.

There is this basic symbolic meaning. And there is the design function—the need for a strong element which can be seen from a distance, yet serves to balance the many elements of the mural.

This initial use of light for creation of a radically new mobile environment has been an interesting experiment. We have learned much that is being applied to the mural for the new Time-Life Building in New York. It is more apparent every day that a static or conventional mural no longer meets the demands of the 20th century for frenetic change. For such kaleidoscopic moods, we design with dynamic techniques for heightening the interest in heroic facades.

About the Author . . .

WILFRED J. LEBRUN formed the Lawrence Adhesive & Chemical Company in 1950 and is now its president. A graduate of Boston University Law School, he has been in the adhesive and chemical business for 24 years. He began in 1932 by working for C. L. Hawthaway & Sons, Lynn, Mass.

42,000 Sq. Ft. of Tile Bonded to Curtain Wall Panels

More than 7,200,000 tiles were used in the panels of the Alberta Wheat Pool Building

The world's largest adhesive-bonded tile facade was completed recently in Calgary, Canada. Forty-two thousand square feet of ceramic tile facing was bonded to metal-framed structural panels on the eight-story Alberta Wheat Pool Office Building with a special exterior type tile adhesive.

Distinctive in design and appearance, this modern structure is 30 per cent larger than any previous ceramic tile installation in North America. More than 7,200,000 individual tiles were used on the exterior panels.

The curtain wall system employed used panels constructed of ¼-inch cement asbestos board with a three-inch core of fiber glass. The ceramic clay tiles bonded to the interlocking structural panels provide a finished wall no more than three-and-a-half inches thick.

Insulating Values

In spite of the relative thinness of the wall, its thermal insulating values are said to exceed that of standard masonry and most curtain wall systems. The sound insulation properties of the wall are extremely high, and street and traffic noises reduced to a minimum.

Face-mounted ceramic mosaics were shop-applied to the curtain wall panels with Miracle MA-450 Exterior Type Ceramic Tile Adhesive. A full bed of adhesive was spread on the panels with a ⅛" sawtooth trowel. The sheets of ceramic tile were then immediately imbedded in the adhesive.

Allowing time for the bondant to take a firm set, the joints were then grouted with a straight Portland cement which contained an additive to reduce shrinkage. After the grout had cured, the curtain wall panels were transported to the job site.

The adhesive employed is based on a "thin-set" method developed by Miracle Adhesives Corp., Bellmore, Long Island. Requiring no heavy construction equipment and bulky setting materials, it is said to provide a much cleaner job with a minimum of dust and dirt. According to Great West Brick and Tile Ltd. of Calgary, subcontractors who installed the tiled panels, use of this particular adhesive system enabled them to cut their estimated costs by approximately 20 per cent.

Before the exterior panels were installed, sample panels were given severe laboratory tests under extreme weather and load conditions. Engineers of Great West Brick reported that because the adhesive is formulated with non-oxidizing resins, the panels easily passed all safety requirements.

Some of the other modern features of the Alberta Wheat Pool Building include interior wall surfaces with an applied finish of plastic fabric which is nearly maintenance free. The windows of the structure are center-pivoted to allow cleaning from the inside and are protected by column-to-column vinyl fabric drapes instead of the standard venetian blinds.

The Alberta Wheat Pool, a cooperative organization, is an association of farmers financed with capital supplied by its members in proportion to their deliveries.

A sawtooth trowel is used to spread the adhesive on panels constructed of ¼" cement asbestos board with a 3" fiber glass core.

Sheets of tile are imbedded in the adhesive. Joints are grouted with Portland cement.

Bonding Concrete and Mortar to Themselves and to Other Structural Materials

By RAYMOND J. SCHUTZ
Sika Chemical Corp.
35 Gregory Avenue
Passaic, N.J.

Bonding agents for cementitious materials may be classified as types suitable for bonding plastic concrete or mortar to hardened concrete or mortar or other structural materials, and those designed to bond hardened concrete or mortar to hardened concrete, mortar, or other rigid materials. Compounds have been developed which will fulfill both functions. The characteristics required of both types would be:

(1) High bond strength.

(2) Ability to bond a variety of materials to concrete or mortar.

(3) Usable pot life and reasonably fast cure.

(4) Good aging qualities and resistance to alkaline environment.

(5) Simple mixing and application procedure to permit use by ordinary job labor.

These bonding agents are formulated as two-component systems, consisting of a base resin or resins and a curing agent. The base material may be a straight epoxy resin or an epoxy polysulfide blend. The curing agents vary according to the base formula, but are usually amines.

Since these materials are generally used on construction sites, mixing procedure and the ratio between the two components should be kept as simple as possible. The optimum ratio of the two components would be 1:1. Such a ratio is easily measured in the field, but not always obtainable with the particular chemical system employed. Even then, experience has shown that measuring even a 1:1 ratio in the field cannot be reliably done by job labor.

It is best to package these systems in units so that full units are mixed rather than measured from the can. To facilitate thorough mixing, the components should be manufactured in different colors so that improper mixing is evidenced by streaks or non-uniformity of color. The pot life of the mixed component should be long enough to permit complete use of the adhesive before stiffening begins.

After stiffening, curing time should be as short as possible to permit removal of shores or temporary fastenings as soon as possible. Where plastic concrete or mortar is to be bonded, curing time should approximate that of the setting of the concrete or mortar.

Curing time will be affected by temperature, becoming longer as temperature decreases. It is not recommended that these compounds be used below 60°F. as curing time will be excessively long and depending on the chemical system might be erratic.

The flexural strength of regular high grade concrete will be in the area of 600-800 psi. The bond strength of these adhesive systems is far in excess of that figure, and bonds obtained will be stronger than the concrete or mortar itself. If failure occurs in such a bonded system, it will not be through the glue line but usually through the new concrete as this will be slightly weaker than the old concrete.

When bonding a broken section of concrete together, an adhesive with good gap-filling characteristics is required. As concrete or mortar does not break clean, pieces of aggregate, sand, and cement paste will powder off. The adhesive will have to be viscous enough to fill the gaps left by these lost pieces. Where the bonding agent is to be used only with plastic concrete or mortar, a low viscosity is desirable to permit economies in application and coverage.

Portland cement paste is highly alkaline, having an average pH of between 11-13. The adhesive used to bond cementitious material will have to be resistant to this alkaline environment. In many instances the sections bonded will be exposed to other chemicals such as cleaning solutions, food acids, etc. The bonding agent must also be resistant to such injurious solutions.

As with all bonded assemblies, the bond strength obtained will only be as good as the bonded surfaces. Surface preparation is extremely important. Hardened concrete and mortar usually has a layer of weak surface laitance and scum. The tensile strength of this surface laitance will be in the order of only 75-150 psi.

This surface scum must be removed by sand blasting, acid washing, or chipping if bond strengths in excess of this figure are desired. Where steel is to be bonded to concrete, mill scale should be removed from the steel. The bond strength of mill scale is only in the order of 75 psi in tension. Aluminum surfaces to be bonded should be cleaned by sand blasting, steel wool, or alkaline etches. The importance of surface preparations cannot be over-emphasized.

About the Author . . .

RAYMOND J SCHUTZ is vice-president of research and development at Sika Chemical Corp. He is a member of the American Concrete Institute and various technical organizations.

The adhesive will usually be available as a two-component unit, with the proper weight of each component preweighed by the manufacturer. To insure complete emptying of the containers, the cans are usually opened with a can opener. The two components are then thoroughly mixed, either by hand or by use of a slow speed electric drill equipped with a paddle. Such paddles are available commercially or can be made on the job by the average contractor.

The adhesive can then be spread by brush. When bonding to a hardened cementitious material, brushing has proved the best form of application as any dust which might be left on the surface is combined into the adhesive and acts as a filler rather than a bond breaker—which would be the case if the adhesive were sprayed. The adhesive can be applied to a concrete highway using ordinary Tampico fiber brooms.

If the particular adhesive formulation does not contain any solvents, fresh concrete or mortar can be applied immediately. If the adhesive formulation contains a solvent, the solvent must be allowed to evaporate before application of the plastic mortar or concrete. Concrete or mortar is then applied, using standard concreting techniques.

Gap-Filling Properties

When bonding broken pieces of concrete together, or bonding steel or other metal shapes to concrete, an adhesive with good gap-filling properties is required.

Adhesive systems, such as those described, have been used for many structural purposes in bonding cementitious materials over the last five years. These applications include:

(1) Bonding of thin concrete or mortar overlays to base concrete.

(2) Bonding additional concrete to structural members, such as lengthening or widening slabs, beams, or stair treads.

(3) Bonding load transfer devices and shear connectors to concrete.

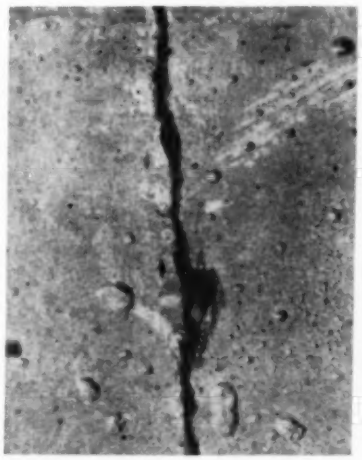
(4) Bonding of broken sections together and the fastening of wood, metal, plastic, and concrete signs and decorative devices to concrete and masonry.

The service life of such installations indicate that the adhesive should last as long as the economic life of the structure.

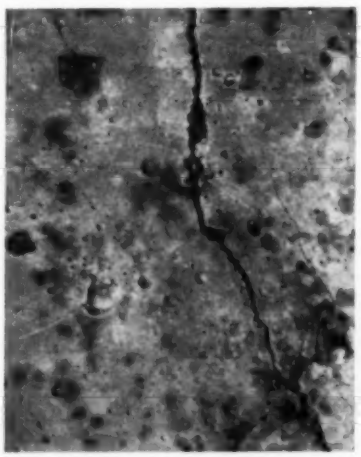
The above article is based on a talk given at the 1960 Spring Conference of the Building Research Institute.

Adhesive is applied to concrete highway with ordinary Tampico fiber brooms. Brushing is the approved method of applying the adhesive to hardened cementitious material because it incorporates any surface dust which then acts as a filler.

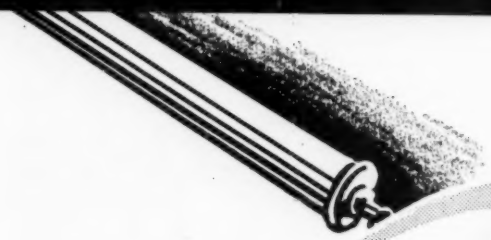
Standard concreting techniques are used to apply the concrete or mortar. If the adhesive used contained a solvent, time must be allowed for the solvent to evaporate before applying the concrete. Solventless adhesives permit immediate concrete application.



A standard concrete beam broken in a flexural test. Loss of sand, concrete dust and aggregate prevents mating of pieces.



Beam which had been bonded together and broken in a standard third point loading test of bond strength.



ADHESIVE BONDED BRAKE LININGS INVESTIGATED

The first adhesive-bonded brake linings came into being accidentally. A few years before World War II, S. G. Tilden, operating a chain of brake service stations in the New York area, experimented with a chlorinated rubber asbestos mixture as a filler between brake shoe and riveted lining as a palliative for squeaking brakes.

He found that the filler held the lining tightly to the shoe even after the rivets were removed, having cured up under the heat and pressure of actual braking. The filler was thermoplastic, however, so a search was started for a thermosetting compound. The search was successful and the bonding of replacement brake linings was launched as a new service to car owners.

World War II interrupted the normal progress of the idea. However, shortly after the war (about 1947-48), Chrysler and Chevrolet began bonding linings to shoes as original equipment.

Chrysler used the adhesive in a liquid state and Chevrolet in an unsupported tape form. By 1950 the principle of bonded wheel brake linings was being accepted by more and more car owners. As a result, a steadily increasing number of automotive dealers, as well as independent repair shops, set up to supply replacement, or rebuilt, brakes on the adhesive bonded lining principle.

Progress was relatively slow, at first. The adhesives suitable for a high volume production operation were not always suitable for a shop operation involving the bonding of perhaps only a few shoe assemblies per day. Efficient equipment for application and cure of the adhesives was not available. Mechanics who were familiar with the riveting process were not provided with correct techniques for bonding the linings to the shoes. A full scale, thorough and expensive job of field training and education had to be done by adhesive and equipment manufacturers.

It soon became apparent to the good business men among these jobbers and shop owners that a system of centralized bonders, operating with properly designed equipment and adhesives, could do a better job at lower cost. The bonded shoe exchange plan began to grow.

As a result, we have today about 200 bonders supplying the thousands of U. S. and Canadian dealers and shops. New and highly effective equipment has been provided, along with improved adhesives. The quality of work in this highly specialized field has steadily improved. Many of these bonders serve areas as large as eight or ten states with their own tractor-trailer combinations.

The really good adhesives and equipment manufacturers have contributed substantially to the increase in efficiency, reduction of costs and the professional techniques among the brake rebuilders by the design of new and better equipment and by the formulation of better adhesives specifically compounded for this job.

The above background material leads naturally into a discussion of the growth of techniques, equipment, and adhesive quality in all of those areas which affect adhesive bonding quality.

By CORD LIPE

Chief Engineer, Adhesives
The Permafuse Corp.
Westbury, N.Y.

With apologies to Erle Stanley Gardner, these processes and materials which have a direct bearing upon adhesive bonding of lining to brake shoes will be offered as "Case Histories."

The Case of the Unclean Shoe—No adhesive will bond well to an unclean surface. The criminals are grease, dust, rust, hydraulic brake fluid, and other enemies of adhesion.

In the early days cleaning was done with an air hammer and chisel to remove the old lining, a vapor degreaser to remove oil or grease from the shoe and a sanding belt or grinding wheel abrasion of the shoe table to reach virgin metal.

However, "cost"—another scoundrel—raised its head. The "Perry Masons" among the adhesive manufacturers and the bonders, who wanted to equal or better the quality of a "factory" job, were called in. Today most good bonders burn off the old lining and thus oxidize the grease, hydraulic fluids, and other contaminants. Then the shoe is shot blasted to original brightness in such equipment as made by the American Wheelabrator Co. or the Pangborn Co. The shoe is now in condition for the next step.

The Case of the Shoe Coat—Even after such thorough cleaning, the "Prosecutors" pointed out that many shoes took on a coat of rust very quickly. The "Perry Masons" of the industry solved the case with shoe coatings, and gained some additional advantages.

The most widely used shoe dips or shoe coats are phenolic resins dissolved in ketones or alcohols or blends and are usually used in a solids concentration of from 5 to 20

per cent. They dry quickly and a continuous protective film is deposited on the shoe.

Added gains are better appearance of the finished shoe assembly and, better wetting or adhesion to the shoe. The shoe is now ready to accept the adhesive coated lining and this leads us to the next "Case."

The Case of the Adhesive Skimper—Obviously, if there is not sufficient adhesive deposited on the lining so that when dry, there will be as near 100 per cent contact as possible with the shoe table in the pressure bonding fixture, there cannot be adequate contact or bonded area.

The environments in this case are (a) variations in the surface of the lining, (b) variations in the surface of the shoe, and (c) possible variations in the adhesive dry film thickness.

The solution of the "Case" involves a constant watch or control over the adhesive coating operation to insure as near perfect contact of adhesive to shoe in the bonding fixture as possible. Some bonders, who are rapidly becoming unpopular in the industry, skimp on adhesive or actually cut or dilute adhesive as received from the manufacturer. The fraction of one cent per segment saved deserves the contempt and best efforts of the "Perry Masons" of the industry.

It is not physically possible to apply sufficient pressure in a bonding fixture to make a steel brake shoe and a relatively dense lining conform to variations in dry adhesive thickness, which can be as much as .004 to .012 within less than one square inch of area. Thus, after good cleaning and coating of the shoe, a sufficient thickness of adhesive to the lining is absolutely essential to a satisfactory bonded assembly.

The choice of adhesive and methods of application to the brake lining logically become the next case.

The Case of the Roll Coater and Extruder—Selection of adhesive involves several factors, such as viscosity, wet flow characteristics, type and size of linings, bonding fixtures, type of curing cycle available or planned, wetting or flow during the bonding cycle, availability, storage characteristics and probably least important, unit or per segment cost.

In this case, only viscosity and wet-flow properties are considered. The other factors will be considered in subsequent cases.

The brake rebuilders or bonders almost universally apply adhesive to lining with either a roll-coater or extruder. Each has certain advantages under certain conditions.

The most popular roll coater uses the principle of serrated discs mounted on a shaft. The discs are ⅛" wide and spaced ¼" center to center. The top surfaces of the serrations are flattened and the teeth are tapered to apply a continuous bead of adhesive. A sensitive doctor blade controls amount of adhesive pick up. Choice of the number of discs in the coater assembly to be used is controlled by the width of the particular lining being coated.

The chief advantages of this system are:

(a) The relatively larger surface area of exposed adhesive after application allows a very quick solvent flash-off. The coated segment can be rested on edge at once after adhesive application without flow-down of adhesive. Hence, better control of adhesive dry film thickness.

(b) A comparatively low viscosity adhesive can be used. Low viscosity adhesives, especially of the nitrile rubber-phenolic resin type, have better shelf life than higher viscosity—or extruder—compounds of the same type.

(c) The high angle of repose or contour of the applied beads assures good contact with the shoe table.

(d) The series of beads presents an attractive appearance.

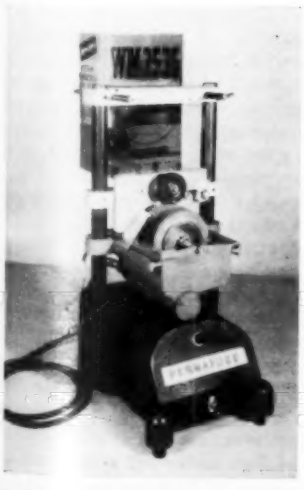
(e) Less adhesive is required to accomplish the desired objectives.

Extruders are of two types:

(1) Those which apply a continuous layer through a die opening across the segment (some leave a vacant strip down the center).

(2) Those which force the adhe-

Equipment for Adhesive Bonding Brake Linings



In the coater above, a sprocket applicator turns in a reservoir of adhesive.

The above unit for bonding brake linings includes an air-operated clamping table and a special bonding oven. The dimensional stability of the lining is important.

sive through a tube containing holes at intervals of ⅛" to ¼".

The extruders which force the adhesive through a die opening and apply a wide band of adhesive require an adhesive of quite high viscosity in order for the cross section of applied adhesive to remain in the extruded dimensions. If viscosity is a little on the low side, slumping, or wet flow occurs. This results in an uneven dry film of adhesive with consequent poor contact with the shoe at the thin adhesive point in the bonding fixture.

In order to maintain the applied adhesive contour, viscosity must be very high. High viscosity nitrile adhesives do not age well in storage. They are extremely heat sensitive.

Proper application of adhesive to the lining does not necessarily guarantee a good bond. One more production operation is necessary to assure a good bond, namely—the bonding cycle of temperature, time and pressure. However, another variable enters here, before we can finish these cases.

The Case of the Variable Lining—One of the most puzzling and exasperating problems of the bonder, and the adhesive manufacturer, is the fact that linings, especially new compositions or variations of former composition, are introduced without a prior test of bondability.

Too often, a lining is introduced to the trade which has not been tested as to which, if any, available adhesive will satisfactorily "wet" to that particular lining. In addition, it has not been tested to see whether it contains thermoplastic materials which may migrate into and plastisize an adhesive during the curing or bonding cycle. Relative dimensional stability of the lining under the bonding heat cycle is another important factor in bondability.

Considering that about 80 per cent of all replacement brakes have bonded linings, it would seem to be in the self-interest of lining manufacturers to submit any proposed change in lining composition for testing by principle adhesive manufacturers and bonders known to operate under good quality control conditions.

The Case of the Bonding Cycle—The bonding cycle is made up of three inter-related and inter-dependent factors—temperature, time and pressure.

Some adhesive compounds will tolerate, for cure, a temperature range of 350° to 425°F. in a time cycle of 20 down to 10 minutes. Others must be cycled in the range 375° to 405°F. in a time cycle of 20 to 14 minutes. Still others will accept 390° to 425°F. in 12 to eight or nine minutes.

There is a direct relationship between "wettability" of an adhesive and the curing time cycle. Usually, those adhesives which will tolerate a short cure time and higher temperatures will flow or "wet" the adherends less well than the adhesives which are designed for a somewhat lower temperature and a longer time cycle.

Pressure Controversy

There has been, and still is, considerable controversy in the matter of pressure. Hundreds of thousands of very good bonds have been made at average pressures of 50 psi. Naturally, the shoes and linings were clean, there was an adequate dry film thickness of adhesive, the bonding cycle of time and temperature was correct and the adhesive was designed for the cycle being used.

It is felt that this "pressure controversy" arises from the fact that in metal-to-metal bonding, where surfaces are very flat and highest possible strengths are desired and where thin adhesive films are indicated, pressures of 300 to 500 psi are found advantageous. However, the adherends in bonding of lining to brake shoes are not similar and the service conditions and desired results are vastly different.

No amount of pressure can compensate for poor brake shoes cleaning, for surface variations of .010 to .018" in the steel, variations in lining surfaces of .004 to .008", and variations of .004 to .016" in dry adhesive film thickness on a lining.

The modern bonder is operating at large volume and with considerable capital investment. This is a highly specialized business and must produce finished bonded wheel brake assemblies of the highest quality. It is only natural, therefore, that he has looked long and carefully at tests which will quickly and surely tell him *whether* his quality of bond is up to par, if not, *precisely* where his difficulty lies.

The Case of Quality Control Tests—One non-destructive test is to apply a load in shear to one edge of the bonded lining which is deliberately lower than the internal strength of the lining itself but high enough to indicate a very poor adhesive bond. At best, this method tells the operator only that the bond is sufficient so that the lining will probably not fall off before installation.

The operator knows nothing about the per-cent of adhesive contact, the degree of wetting or adhesive penetration into the lining surface, whether there may be areas of poor or no adhesion to the metal table of the shoe, whether his shoe coat is adhering well to the shoe *and* the adhesive, whether the adhesive may be under-cured or over-cured, or whether there may be evidence of debonding, or actual oxidation of the lining or adhesive, or both.

Since any good adhesive will have a higher shear strength than that of passenger car and practically all truck linings, a system which shears off the lining in large sections mostly reveals only the strength of that particular lining, and perhaps only limited information about wetting, per cent of adhesive area in contact, or spotty adhesion to the metal.

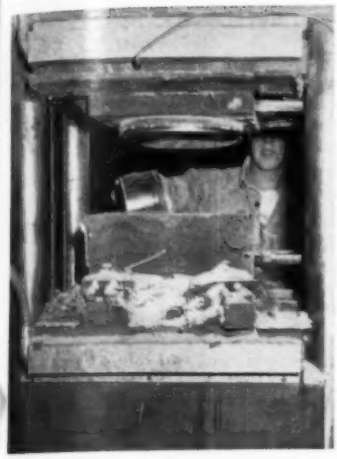
Many of the good operators are beginning to use a chisel test and cutting down through the adhesive to secure visual evidence of the essential questions he wants answered.

Since re-conditioning shoes is costly, and lining and labor are important cost factors, the operator maintains close control in all the "Case" operations outlined above so that destructive chisel tests may be necessary only on about 1 in 1000 bonded assemblies.

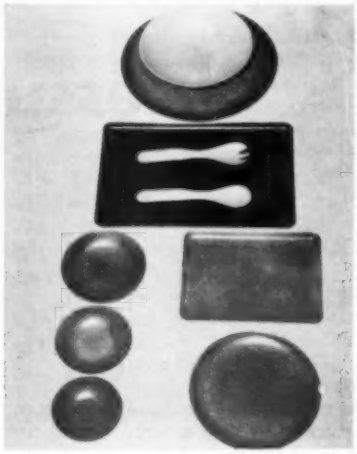
In summation, the modern manufacturers of brake shoe bonding adhesives must supply a co-ordinated system of adhesive compounded to perform satisfactorily in the bonder's equipment and volume environment, a good shoe coat, a fast method of applying the proper amount of adhesive to the lining, a test to determine whether new linings will degenerate the adhesive, and a bonding oven set-up that is engineered to the bonder's general requirements.

The adhesive manufacturer, if he is to keep pace with the quality objectives of the modern bonder, must be prepared to "custom make" adhesives to meet the various operating variables. He must also continually develop better adhesives. He must be prepared to provide a high order of prompt and skilled engineering field service and must constantly develop more efficient equipment.

Before joining Permafuse, Mr. Lipe was manager, adhesives, of the Cycleweld Division of Chrysler Corp. He holds a BS in chemical engineering from the University of Illinois.



The three photos here trace the production process at Ability. First a female mold cavity is manually loaded with the wood flour-adhesive mixture. The 300-ton press is then closed for approximately four minutes. A complete set of Flintwood dishes is shown in the photo below.



Adhesives in Tableware

Wood flour, a material produced by granulating and pulverizing wood scraps, has been used for many years as a "cheapener" or "bulking agent" in plastic molding compositions, caulking compounds, etc. Until recently, however, efforts to make full use of the inherent physicial properties of its cellulose fibers were unsuccessful because it seemed to be impossible to reunite the fibers as skillfully as they had been initially bonded by Mother Nature.

Now, thanks to a urea-formaldehyde adhesive, Ability Products Co., Pasadena, Calif., is converting wood flour into moldings with many qualities that are actually superior to the properties of natural wood materials.

These moldings are known as Flintwood tableware products. They have the thin walls, glossy surfaces, color effects, and moisture resistance of top-quality plastics and ceramics; yet they can withstand shocks or blows that would shatter plastics or ceramic products which cost considerably more.

The first step in making Flintwood tableware consists of mixing 80 parts of wood flour with 20 parts urea-formaldehyde adhesive. Previously-used wood flour compounds were composed of greater quantities of resin than wood. This was because of the difficulty of dispersing a small quantity of binder so that it will assure the satisfactory adhesion of many small wood particles. Ability Products has solved this problem by making use of a powder-type adhesive.

Monsanto Chemical Company's Lauxite UF-71 resin proved to be an ideal adhesive for this work for several reasons. First of all, it is a thermoset which can be obtained as a heat-fusible powder; however, it cannot be resoftened with heat, once it has been molded. Secondly, it is one of the few plastic resins that can be pigmented with many light colors without danger of excessive fading due to aging. Finally, it is capable of producing adhesive bonds that are comparable to the bonds in natural wood and will insulate wood particles so that they will not be susceptible to moisture after they are adhered.

Centrifugal Mixer

Powder materials for Flintwood products are mixed with a centrifugal machine which is functionally the same as dough-mixers used by bakeries. Then the quantities of mix needed to make individual products are handloaded in the cavities of molds mounted on three compression presses.

The molding materials are heated to 325°F. as the presses are closed. Compressive forces exerted range from 2500 to 3000 psi, depending on the dimensions of the articles that are being produced. The average molding cycle is four minutes.

When it is removed from the die cavity of a compression press, the individual molding usually has small quantities of "flash" around one of its edges. This must be removed with grinding equipment. However, no other processing operations are required after the molding cycle is complete.

About two to five per cent of the subject products have been rejected because of various defects, most of which are attributable to the inadequate bonding of wood materials. However, this indicates no basic deficiencies in processing since the successful production of moldings of any type depends to some extent on such unpredictable factors as atmospheric conditions, mechanical failures, and, of course, human errors in general.

As a method of reclaiming scrap wood materials, Ability's process should find a vast number of new applications as it reduces the cost and improves the quality of many types of compression moldings. Also, it seems more than likely that with slight variations it can be used to reclaim other scrap materials besides wood. For example, scraps of leather, converted into a suitable flour, can probably be rebound with elastomeric resins in the manufacture of moldings or stock materials with many of the physical properties of natural leathers.

By JOHN S. TORREY
Vice-President
Avery Label Company
Monrovia, California

Some pointers on

Pressure-Sensitive Labels

An examination of some of the advantages enjoyed and problems encountered in using both permanent and removable labels

Pressure-sensitive labels adhere to a surface by simple contact—without heat, solvent or moistening activation. They were first made possible following a series of inventions 25 years ago by R. S. Avery, chairman of Avery Adhesive Products, Inc.

In the last quarter of a century, the pressure-sensitive label has found many applications in all phases of business and industry throughout the world. They meet the need created by modern production techniques for a faster, more dependable and efficient labeling method for use in identification, assembly marking, instructions, sales promotion on products, price marking, packaging, food labels, carton contests, service labels, direct mail, or service guarantees.

Pressure-sensitive labels can be made of paper, foil, plastic or fabric. One side of the label may be printed on, and the other coated with adhesive. The label is mounted on a backing sheet which protects the adhesive from contamination. This sheet serves as a carrier in automatic and semi-automatic label dispensing. It also prevents sticking together before use (Figure 1).

The pressure-sensitive label was originally of the type which could be easily removed, without leaving a mark or stain on the labeled surface. An example of this is the Kum-Kleen removable label. During 1954, Avery introduced a permanent bonding pressure-sensitive label called Perma-Grip. Last year an improved version, the Golden Perma-Grip, was marketed. The latest development boosts adhesive qualities by 300 per cent.

Two Label Types

Generally, removable adhesives are compounded from natural rubber, butyl or Vistanex, as these polymers do not harden with age. With permanent-type adhesives—polymers such as neoprene, polyvinyl ethers, butadiene-acrylonitrile, butadiene-styrene, or the acrylic elastomers are compounded with or without tackifying resins. These polymers usually form the base of the permanent pressure-sensitive labels.

An early Avery discovery was that common adhesion test techniques are not applicable to the development and control of pressure-sensitive labels. Avery's research and development Laboratories consequently devised their own effective methods. In addition, Avery established the fact that definite adhesive values cannot be rated for all kinds of materials, but would only be applicable for specific cases.

Though Avery has assumed the burden of control and guarantees its products, it recommends that customers make a final evaluation of the labels on their products whenever any question of applicability arises. The company particularly recommends a simple test: Subject the labeled surface to 160°F. temperature for one week (this duplicates one year of normal aging at 70° to 80°F.). As a rule-of-thumb guide, this test is generally satisfactory, although results may vary greatly, depending on the surface to which labels are to be affixed.

Pressure-sensitive labels, especially those made from paper, must be considered perishable, as they are organic in nature. It is therefore suggested that they be stored in cool, dry areas. Inventory should not exceed a two-year supply and proper stock rotation should be observed. This is a recommended safeguard, even though some labels have maintained excellent quality for periods of more than 10 years, and were ready for use when needed.

Choice of proper material for the label is based on the user's requirements, such as color, surface finish (matte or glossy), or transparency. A specific application may call for toughness and indicate the use of impregnated papers or Mylar. Where high heat resistance is a requirement, plain metal foils or specially formulated papers may be selected. Where difficult-to-adhere-to surfaces are encountered, materials such as light-basis-weight papers, or crepe papers are recommended.

Though pressure-sensitive adhe-

About the Author . . .

JOHN S. TORREY, vice-president and general manager of Avery, joined the company in 1948 as general sales manager and has been instrumental in fostering pressure-sensitive advances during the last decade.

sives can be formulated to adhere to a wide variety of surfaces and materials, surface conditions are an important factor to consider.

Pressure-sensitive labels adhere best to reasonably smooth surfaces. Difficulties may arise on very rough surfaces. A rough surface may be considered as a series of hills and valleys and if the label adhesive only contacts the peaks, the effective adhesive force is reduced proportionately. A microscopic cross-section of a pressure-sensitive label on a very rough surface would look very much like Figure 2. On smooth surfaces, 100 per cent contact is achieved and labeling conditions are ideal. The cross-sectional view on smooth surfaces is shown in Figure 3.

Occasionally, surfaces with a very microscopic roughness are encountered, such as anodized aluminum. In these cases, more than 100 per cent effective surface contact is achieved (Figure 4). Adhesion to this type of surface is very easy to obtain, although difficulty may be encountered on label removal because of the degree of adhesion.

General cleanliness of surface to be labeled can also affect the behavior of pressure-sensitive labels. Surfaces should be clean and free from all loose particles. The label adhesive will stick well to dirt, but dirt lacks adhesion to the surface it is on. A label failure of this type always shows dirt particles covering the tacky adhesive. Soap and wax films, as well as chalky paints, may present similar difficulties.

Another important aspect is the curvature of the surface to which the label is applied. Flat surfaces, of course, offer no problems, since minimum adhesive force is necessary to properly hold down the flat label. When the surface is curved, additional adhesive tack is required to overcome the natural stiffness of the label material.

Snap-Back Tendency

Paper can be likened to a clock spring, since it has an inherent tendency to snap back to its original form, as is shown in Figure 5. The greater the curvature of the surface to be labeled, the greater will be the spring-back force in the applied label, and the greater the adhesive tack needed to overcome it. Use of limper papers is one solution to this problem.

Where labels are to be applied to surfaces with a double or compound curve, label design can be used effectively to combat springiness. Paper is not stretchable. It will not form around a ball, but will lap at various points. Selection of small or long and narrow labels to minimize the strain effect can help meet this problem.

Atmospheric conditions have relatively little effect upon pressure-sensitive labels, except where surfaces to be labeled are hygroscopic. At low freezing temperatures, both permanent and removable labels remain firmly affixed. At above 160°F., the removable type adhesive generally breaks down rapidly. Heat over 750°F. results in rapid and complete breakdown of the removable adhesive without residue. Short-term exposures to heat as high as 300°F. usually produce no undesirable effects.

These limitations are not applicable to permanent-type adhesives, and long-term exposure to temperatures as high as 400°F. are practical. No general statement can be made on limitations, but proper choice of material is important for extreme temperatures. For example, paper chars at 300°F., although Avery's permanent-type adhesive is quite immune to heat as high as 500°F.

The extremely high plasticizer content of plastic coated bottles often results in softening of adhesives. This is brought about by plasticizer migration and subsequent penetration through the adhesive. The consequence is usually a greasy looking label. In addition, ink smudging and lifting is possible.

Some removable adhesives are resistant to this type of action. In extreme cases, a metallic foil label paper is recommended, since the metal acts as a barrier against penetration.

With new applications being constantly discovered for pressure-sensitive labels, currently available items go far beyond those of 25 years ago, when Mr. Avery pioneered the field.

How Pressure-Sensitive Labels Work

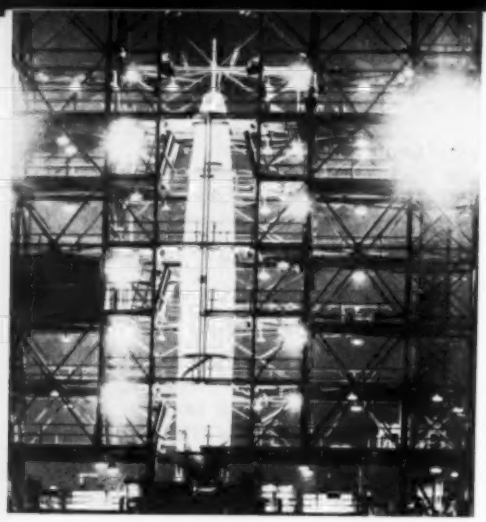
Figure 1—Label Composition

Figure 2—Very Rough Surfaces

Figure 3—Very Smooth Surfaces

Figure 4—Slightly Rough Surfaces

Figure 5—Paper's Resiliency



Developing Ceramic and Inorganic Adhesives for Missiles and Jets

Outstanding developments in the fields of missiles, jet aircraft, and atomic-powered heat engines have stimulated accompanying developments in high-temperature programs. New methods of using ceramics and inorganic materials are playing an important role in these developments. For example, in regard to ceramic mixtures for structural adhesives, satisfactory adhesives are obtained after maturing at temperatures ranging from 1000° to 2000°F. Adhesive tensile lap-bond strengths have been developed ranging from 2000 to 5000 psi at room temperature. At temperatures of 1000°F., properties have ranged from 1000 to 3000 psi.

Expanded Research

In the past two decades, research programs aimed at the development of new organic base adhesives with improved properties have proceeded at an expanding rate. These programs have substantiated the reliability of adhesive joints in various industries. They have also provided combinations of higher strengths, simplicity in quality control, and/or low cost processing.

With the development of new products, and the acceptance of adhesives as a reliable method of bonding, the original government-sponsored development programs expanded into direct commercial development laboratory programs. The result was new and profitable adhesives firms.

Typical applications in this modern era are truck bodies, table tops, automotive brake bands, automotive bodies, building partitions, ceramic tool bits, oil well tubes, aircraft structures, jet engine shrouds and missile motor bodies. These applications call for organic type structural adhesives which are combinations of epoxy-phenolic, vinyl-phenolic, nitrile-rubber-phenolic, nylon-phenolic, etc.

Modern aerospace vehicles and ordnance equipment rely on the use of these structural type organic adhesives. Typical examples include missiles (Atlas, Terrier, Titan, Honest John, etc.), aircraft (B-36, B-52, B-58, etc.), ground and water vehicles, etc. For example, the B-58 Hustler high-speed aircraft uses over 1000 lbs. of adhesives.

As aerospace temperature requirements increased, however, available adhesives became limited in new applications. Military research and development efforts in improving the heat resistance and thermal stability of adhesives are primarily concerned with (1) inorganic or metallic fillers providing for non-oxidation reactions with organic binders, (2) inorganics, and (3) ceramics.

The organic programs have developed adhesives operating up to 500°F. for relatively long-time service. Organic adhesive polymers are being developed to withstand short time exposures at temperatures above 500°F.

For example, tensile shear strengths of 2000 to 3000 psi have been developed at room temperature. Retention of approximately 50 per cent strength exists after 10 minutes at 700°F., and retention of approximately 20 per cent exists after 10 minutes at 1000°F. Current major development programs concerned with organic adhesives involve the preparation of special fillers (metallic oxides, etc.) and additives to provide closer molecular bond (arsenic pentoxide, etc.)

Semi-organic polymer adhesives have recently been developed which provide structural strength up to 1000° F. for short periods of time. The most promising systems incorporate modified phenolics. The inorganic filled epoxy-phenolics and silicone-phenolics have been developed and evaluated with promising results. Narmco Industries, Inc., working with arsenic pentoxide has provided important new developments in this field.

Oxidation Degradation

Note that the tightly cross-linked phenolics alone are extremely susceptible to oxidation degradation. The weaker cross-linked epoxy alone becomes thermoplastic at the higher temperatures.

Another modification is epoxy-novolak which provides for a tight cross-linked polymer. Curing agents such as melamine (semi-organic compound) and arsenic pentoxide (inorganic compound) are suitable to cross-link the epoxy-novolaks.

Silicone-phenolic compounds have been developed showing improved high-temperature properties. The compounds are generally prepared by the interaction of a phenolic compound with siloxane. Compared to the semi-inorganic polymer systems, siloxane-phenolic resin adhesive compound systems prepared with an equal weight of aluminum powder systems have provided maximum strength retention when tested at 500°F. or above.

Other type inorganic adhesives are generally classified under the head-

By D. V. ROSATO
Telecomputing Corporation
Newton 68, Mass.

As temperature requirements have increased, currently available adhesives became limited in new applications, and new research was gotten underway to develop formulations capable of providing bond strengths that are in keeping with the requirements of the Space Age

ings of sodium silicate, portland cement, magnesium oxychloride, magnesium oxysulfide, plaster of Paris, and ceramics.

Probably one of the most spectacular technical growths in the past seven years has been in the field of ceramic adhesives. With the advent of supersonic aerospace vehicles, military requirements called for the development of these high-temperature-resistant bonded structures. Wright Air Development Division, Bureau of Naval Weapons, Army Ordnance, and industrial subcontractors have successfully developed ceramic adhesives for bonding steels and other alloys for uses under operational conditions ranging from 700°F. These developments are relatively recent and are now being evaluated in sample end items.

Original work resulted in providing high-strength bonds using ceramic-oxide glassy-bonded adhesives. However, because of their poor moisture resistance, these adhesives had only limited application.

Recent Achievements

A glance at achievements of the past year will show that technical progress in this new field is making history and is the basis for setting up a needed and profitable industry. It should be noted that ceramics used directly as adhesives have not proven successful because the material is too refractory in nature. However, if the component materials themselves are finely ground and incorporated in a glassy matrix, structural adhesive properties exist. The original work in this area involved equal weights of lead borosilicate glass and metallic cobalt.

The general procedure for preparing ceramic adhesives is not complex but requires detailed controls. A typical formulation is made up of 25 per cent by weight of silica, 9 per cent sodium nitrate, 65 per cent boric acid, and one per cent ferric oxide. Laboratory batches of this composition are made by heating the smelting crucible to approximately 2400°F. and adding approximately half of the mixed raw materials. Laboratory batches range from 1000 to 2000 grams.

Heating the mix for approximately 20 minutes will stop the frothing action prior to adding the remaining mix. After the remaining mixed batch has been added, the procedure is to continue heating for 60 to 90 minutes until all frothing has stopped. The temperature of the smelting crucible varies depending on formulations used. It can range from 1000° to at least 4500°F.

In the next step, the molten glass is quenched in a bucket of cold water. After the hard frit has formed, it is dried and milled in a ball mill until it is of uniform size. Control is set up by passing it through a screen (such as 48-mesh screen).

After adding oxides (or other fillers) and approximately an equal weight of water in the ball mill, a slip is formed. This slip can be made into bisque, prepared for dip operations, or sprayed on the metal sheets to be bonded. All metal sheets are properly cleaned (degreased, chemically etched, etc.).

The influence of surface conditions of the base metal on the shear strength of ceramic adhesive has been quite evident. Tests have indicated that preoxidation of bonded surfaces greatly increases strength. Another consideration in applying the adhesive to metal parts concerns the trend to produce better bonds by preheating the metal (in the temperature range of 350°F.) so that a more tenacious bisque is formed.

During actual formation of the metal-to-metal bond, pressures ranging from 2 to 15 psi are developed with maturing temperatures ranging from 1000° to 2000°F. The actual pressure and temperature condition is dependent on the adhesive properties to be obtained, type of metal, type of structure, and desired bond line thickness. Metal bond maturing temperature time can range from a few minutes up to one hour. The final operation involves cooling the unit at controlled rates to eliminate internal stresses, etc.

Reduced Temperatures

An important phase of development in the past year has been to reduce the maturing temperature of glassy system adhesives for application from 2000° to 1000°F. Various techniques have been used such as low melting flux additives (lead oxide and barium oxide) and low melting porcelain enamel frits. Other compositions are based on lead silicate glasses with varying amounts of sodium oxide and titanium oxide. The target for these structural type compositions is to produce maturing temperatures below 1000°F.

Developments to date indicate that in order to produce high strength bonds above 2000°F., the ceramic compositions require maturing temperatures of at least 3200°F. In addition, more stable and higher temperature resistant crucibles would be necessary in order to prepare the adhesive frits.

Another important recent development has been in air setting systems

About the Author . . .

D. V. ROSATO is assistant plant manager at Telecomputing Corp. His previous experience in adhesives includes work as chief engineer and product manager of the Reinforced Plastics Dept., Raybestos-Manhattan, Inc., and development engineer and plastics technologist for the Bureau of Aeronautics. He has designed materials for the Vanguard, Polaris, Jupiter, Terrier, etc.

which provide for low heat cured adhesives. Aluminum phosphate type ceramic adhesives can provide some strength with room temperature maturing or maturing at a temperature up to 600°F. Other promising air setting adhesive systems contain approximately 30 per cent by weight iron oxide.

Developments to Date

Most of the work to date has incorporated oxidizing atmospheres during the maturing phase. If uncoated graphite pressure plates are used during this process, the ceramic adhesive can discolor and becomes granular in consistency. Preliminary investigators conclude that the graphite reacts with the oxygen to produce a carbon monoxide reducing atmosphere.

Indications are that the addition of metal additives in ceramic compositions can promote excessive oxidation during setting when fired unprotected in air atmospheres. The excessive oxidation can produce cracking or spalling upon cooling, and in turn irregular surfaces. However, the addition of ferric oxide, aluminum oxide, barium oxide, and copper oxide in ceramic adhesives generally results in increased physical properties. The aluminum oxide also increases porosity. A relatively new additive system, which shows some degree of increase in strength of adhesives as well as preparation advantages, is phosphatized carbonyl iron.

Tests at High Temperatures

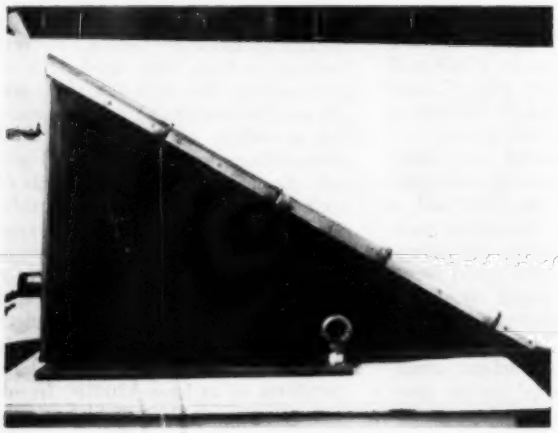
Strength changes due to small amounts of additives generally do not become evident until tests are conducted at elevated temperatures. *For example, when adding approximately five per cent metal powder of aluminum, copper, silicon, carbonyl iron, or carbonyl nickel to ceramic adhesive slip, there is relatively no difference in shear strength at room temperature. The more significant change occurs with carbonyl iron when tests are conducted at 800°F.

Another development has been in the use of metal-glass-forming systems. The term identifies the product where the metal phase is deposited on the steel and the glassy carrier phase is ejected by pressure. The resultant joint has a continuous metal bond. The fluid glass phase (flux) is extruded out of the bond line.

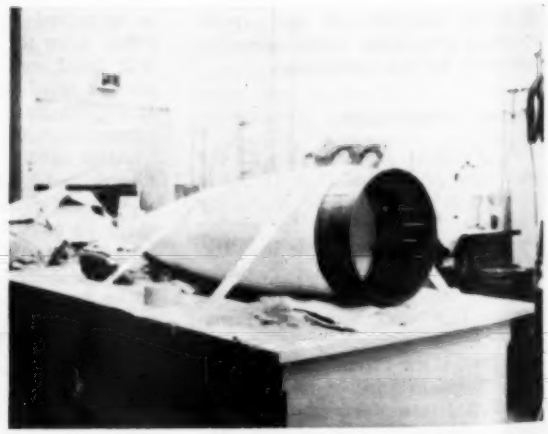
An oxide-metal system is a homo-

*The general metal used for preparing structural test specimens is 17.7 pH stainless steel. Elevated test temperature exposure period is generally 10 minutes. The testing follows immediately.

Typical Applications for Ceramic and Inorganic Adhesives



Missile fin structures bonded with ceramic adhesive are currently being evaluated as part of an expanded testing and development program. Military research and development efforts are concerned with improving the heat resistance and thermal stability of adhesive formulations used in jets and missiles.



Inorganic and ceramic adhesive development programs have played an important part in developing formulations which can be used to bond this all ceramic nose cone to its metal base structure. The programs have not only resulted in higher strengths, but in simplified quality control and lower processing costs.

geneous mixture of oxides and metals which remains in the bond line. All exothermic products are retained within the bond lines. These two systems are presently being developed by Narmco Industries to include the use of isopropyl alcohol during the ball milling operation.

Alcohol suspension systems are dried on a hot plate in order to produce a thick paste. This slurry is used for wet applications. When dry applications are to be used, the suspensions are air dried to form dry powders.

Phase Separation

These exothermic reactive systems provide a glass-metal phase separation and glass phase extrusion from the bond line. This process leaves a continuous metal bond. Phase separation and extrusion are further developed by the addition of small amounts of alumina and/or fine copper powder. Preliminary work in this system was with borax, barium, silicone dioxide and copper oxide.

Adhesive systems consisting of combinations of metals and oxides can react exothermically when fired. The resultant product produces stable oxides and less reactive metals. A typical example consists of 45 per cent glass and 55 per cent copper. Basic glass composition is 17.7 per cent $Na_2O{\cdot}2B_2O_3$ (borax) + 16.4 per cent SiO_2 + 6.4 per cent B + 70.1 per cent CuO. Other metal, glassy systems have basic formulations of 5/3 per cent Mg + 79.8 per cent Cu_2O 9.9 per cent SnO_2 + 5 per cent Ti.

A new and major development was recently reported by Boeing Airplane Co. in the art of low cost bonding of temperature resistant structures by ceramic-braze adhesives. The structural bonds are reported to be superior to present ceramic adhesives, and may prove to be superior to present brazed bonds. The resultant ceramic-braze bond is primarily metallic in composition after firing. This particular development provides for a simplified process for manufacturing large and reliable heat resistant structures.

Recent developments have demonstrated the possibility of producing an adhesive possessing thermal expansion similar to type 17-7 pH stainless steel. Adhesive formulations based on titania-sodium-borosilicate-glasses are applicable in this area. The frits are smelted at a temperature of 2300°F. The maturing condition involves a heat of 1750°F. for 20 minutes with 15 mil thick adhesive bond line.

The development of ceramic adhesives required that evaluation programs include tests on the effect of moisture. Moisture penetration of these systems results in failure due to corrosion of the bonded metal surface or of metallic additives in the ceramic compositions.

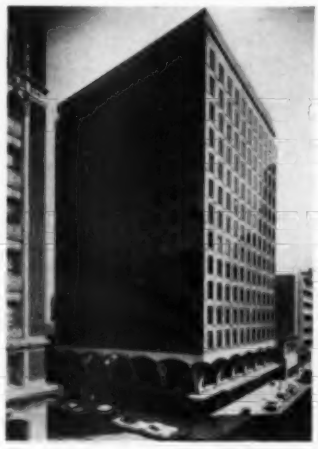
In regard to producing moisture resistant bonds, additions of approximately 30 per cent iron oxide with preliminary heat treatment of one hour at 1000°F. have provided some success. However, lower shear strengths result. Compositions such as SiO_2 (38 parts), Na_2O (5 parts), and B_2O_3 (57 parts) can be made insoluble or less soluble in water by the addition of approximately five per cent by weight of calcium oxide. Other additives that show similar gains are aluminum oxide, zinc oxide, and barium oxide.

Recent developments relating bond line thickness to tensile shear strength show that strength increases as the bond line thickness decreases. However, the minimum bond line thickness can produce low strengths. Generally speaking, bond lines below 12 mils produce adhesive starved joints. It is also interesting to note that the tensile shear strength is dependent upon the bond line pressure only to the extent that bond pressure affects the resultant bond line thickness.

Progress Report

Important progress has been made in the field of ceramic adhesives. Different adhesives are being prepared based on requirements of the best combinations of chemical compatibility, thermal expansion, low maturing or firing temperature, strength, and cost. One of the more typical compositions for high strength involves 70.4 parts by weight of a frit, 1.4 parts of colloidal silica, 28.2 parts of water, and 10 parts of metal powder (carbonyl iron). An example of the composition of the frit is 38 parts of SiO_2, 5 parts of Na_2O, and 57 parts of B_2O_3.

These developments now include the manufacture of some missile component parts. Commercial outlets have been initiated in heavy duty truck and aircraft brakes, electronic units, and bearing blocks. It is expected that within the next several years, the ceramic adhesive industry will make an important contribution to the over-all industrial picture.



Sealing Bronze and Granite Curtain Wall

Exterior sealing of the new John Hancock Insurance Building in San Francisco was completed in December, 1959, just in time to bear the brunt of the area's winter wind and rainstorms. According to the construction superintendent, this was the first building in his 30 years of experience with major construction that went through the annual series of heavy storms "without a single leak."

The upper part of the structure is executed with polished black granite panels and solid bronze fenestration. The lower stories are framed by cantilevered reinforced concrete arches. Thus, many of the structural joints are either stone to stone, or stone to metal.

The sealant used for the building, designed by Skidmore, Owings and Merrill, was a polysulfide compound made by Products Research Co., Los Angeles, Calif.

Before sealing the joints, the curtain wall contractor, prepared surfaces by scraping away all mortar, blowing the joints clean with an air hose and wiping them with methyl ethyl ketone solvent. All window glass was glazed inside and out with PRC Rubbercalk black compound, as were bronze-to-glass, bronze-to-granite and granite-to-granite joints.

Room Temperature Gluing with Electric Presses

A major advantage of gluing with electric presses is that they can be used with any kind of adhesive, even though many laminating tasks do not require the extreme pressure they offer. They can, moreover, be used for room-temperature gluing, as long as it is kept in mind that such room-temperature application is a distinctive process, requiring special techniques.

Cauls employed at room-temperature presses, for example, differ from those employed at hot plate units. One reason for using cauls at a cold veneer press is to prevent glue which oozes from top panels from running down over the edges of lower panels, bonding them together. When this happens it is sometimes difficult to separate the panels in a package without degrading the edges.

In cases where face veneers are thin, absorbent cauls are often employed to take up as much glue moisture as possible. In this way the drying and storage time required before panels can be released from retaining clamps can be shortened. Moreover, highly-absorbent cauls do much to reduce stain and degrading.

Use of Cauls

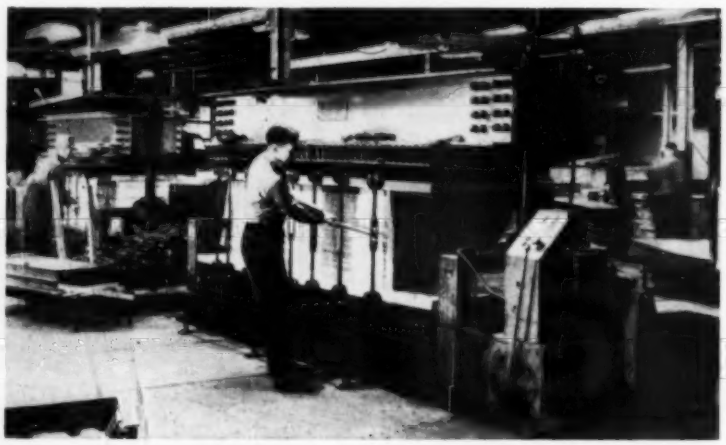
Cauls of heavy thickness are used at the top and bottom of each package to retain uniform pressure over the entire surface of panel packages after retaining clamps have been applied. Use of these cauls also prevents pressure applied by I-beams from marking the top and bottom panels.

To prevent panels from being bonded together, operators sometimes simply place layers of paper between adjacent panels. Should plywood panels become bonded together with paper between them, a sharp chisel edge, introduced between the panels, generally suffices to split the paper through its thickness, and to separate the workpieces without doing them any damage. The paper must be sufficiently thick to keep the glue from impregnating it completely.

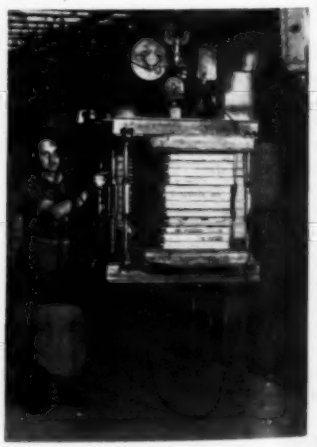
Glue-line cure can be speeded up in cold-press work by taking advantage of the way a particular adhesive sets. Bondants which set through loss of water, such as liquid animal glues, casein, and polyvinyl, are considered room-temperature-setting adhesives. The setting time can be hastened by speeding elimination of water.

Warm air will convey more moisture than cool air, and, therefore, directing a steady stream of warm air at and around glued-up panels

A Modern Laminating Department Setup



Room temperature laminating department with two electric presses. Press in foreground has developed necessary pressure and the retaining clamps have been applied.



Package of cold-press work on its way to storage via monorail setup.

makes the glue set faster, as does good air circulation.

Although urea and resorcinol resins are primarily thermosetting adhesives, they can be employed at temperatures as low as 70°F. Urea, in particular, has been widely used in room-temperature pressing. The actual gluing area and the stock should not be allowed to fall below 70°F. when urea adhesives are employed.

Hundreds of laminating jobs do not require extreme pressure. Motorized screw presses, sometimes referred to as electric units, are often employed in work calling for pressure of 125 pounds per square inch or less. Such presses can successfully handle all cabinet plywood and laminated stock, provided surfaces being joined have been accurately prepared. The presses are often employed for laminating building or insulating boards; applying plastic surfaces to plywood or other base materials; and gluing up hollow-core panels and hollow-core flush doors.

Generally, presses are mounted directly on the floor line. No special foundation is needed since the press is designed so that all strains of the pressing load are confined to the platens and to the portions of the screws between the platens.

Two massive screws are supported by the two end frames. These screws are right-and-left-hand threaded on their two ends. The nuts through which they travel are made integral with the upper and lower platens. Thus, when the two screws are revolved in one direction by power, they draw the platens together on a contained load or package of panels. When turned in the opposite direction, the press is opened.

Retaining Clamps

After the required amount of pressure has built up, retaining clamps, which are also right-and-left-hand threaded, are applied to the ends of pairs of I-beams, which are laid up in the press with the package.

The retaining clamps have forged steel heads that engage the nearest flange of each I-beam. They incorporate a massive turnbuckle at their center-length, which is easily turned up tight by applications of a suitable rod, so that pressure developed by the press will be held on the package after the press is opened. This allows a package to be pressed, retaining clamps applied, and the package immediately removed from the press, thus maintaining fast production and maximum efficiency.

Epoxies Bond Polyester Traffic Markers

Night view of "Botts Dots" bonded to the San Jose-Los Gatos Freeway. The epoxy adhesive used is stronger than the concrete itself.

Thousands of adhesive-bonded glass and polyester traffic buttons mark the lanes of a recently opened three and a quarter mile section of California's San Jose-Los Gatos Freeway. The three-dimensional lane delineators represent the culmination of some six years of intensive research conducted under the guidance of the Materials and Research Laboratory, California Division of Highways, Sacramento.

To make them clearly visible in all weathers and at all hours, each button contains several hundred thousand tiny and optically clear glass spheres, the largest not more than .02" in diameter. Imbedded in a virtually unbreakable, white polyester resin, the spheres reflect light from any source.

The buttons are permanently bonded to the pavement by an epoxy adhesive formulation based on Araldite resins supplied by CIBA Products Corp., Fair Lawn, N.J. The flat bottom of the button is simply coated with the adhesive and pressed onto a pre-cleaned, pre-marked spot on the pavement. After curing for as little as 30 minutes—depending upon the temperatures of air and pavement—the button is firmly fixed in place.

Known as "Botts Dots," the lane markers are named for Dr. E. D. Botts, former senior chemist of the Materials and Research Laboratory. Prior to approving them for widespread use, the laboratory made pilot installations of more than 6000 units at various locations throughout the state. An additional 50,000 units have been ordered for future installations.

Underside of buttons before bonding, below, and after being chiseled up from the road, above. Note concrete pulled up with button.

Button manufacturer, Grant Wiswell, discusses "Dots" with Enrico Maggenti, left, inspector for California Division of Highways.

Adhesive Facilitates Metalizing

Spray-coating plastic surfaces with a thin polyester adhesive makes it possible to metalize them by an inexpensive "evaporation coating" technique

An adhesive coating medium is enabling Plastic Dress Up Co., El Monte, Calif., to vacuum metalize plastic moldings for less than the cost of electroplating.

Known as "evaporation coating," the technique makes it possible to heat vaporize a metal such as aluminum so that it can be deposited on surfaces like steam from a teakettle. Oxidation of the coating material is prevented by heating it electrically in a high vacuum.

The process permits the production of extremely uniform coatings that don't have to be buffed or polished before they have a bright lustre. It can be used directly to metalize articles made from dielectric materials.

Despite its many advantages and inherent simplicity, evaporation coating was once thought to be too costly for most large-scale applications. Its use was restricted to applications such as the production of invisible finishes which improve the light-transmitting abilities of expensive camera and telescope lenses. An adhesive-sparked modification of the technique now makes it available for such mass production uses as the coating of plastic toys.

Modified Technique

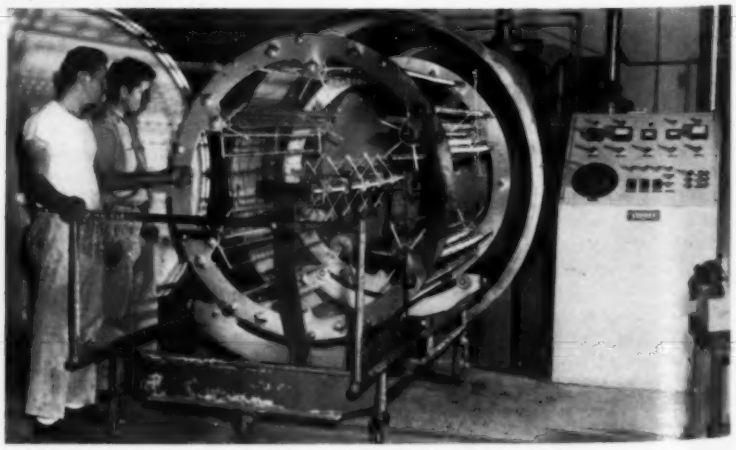
In standard evaporation coating, deposition surfaces had to be immaculately clean. Even the oil from a relatively clean hand could contaminate a surface so that vaporized metal particles would not adhere to it. The modified technique employed by Plastic Dress Up bypasses preliminary treatment by spray-coating a thin, polyester adhesive on the deposition surface.

Oven-drying of the organic coating is necessary to keep the adhesive from bleeding through the metal finish applied. However, the dried polyester retains enough bondability to promote adhesion—as is evidenced by the exceptionally bright metal coatings obtained.

The time required to vaporize and deposit the aluminum averages only about 13 seconds. However, since the work is done in a big vacuum chamber which must be evacuated and repressurized before and after each finish is applied, actual coating cycles range from 15 to 30 minutes —still only a fraction of the time required to do comparable work with the usual types of electroplating equipment.

Because most of the finishes are used to decorate large quantities of identical products, cost is a major factor. It is worth noting that less than one ounce of aluminum can coat more than 3000 average plastic moldings during a single coating cycle.

Plastic mold is adhesive-coated, photo left, by pneumatic spray in preparation for vacuum metalizing. The adhesive is oven-cured to prevent bleed-through. Below, plastic molds going into vacuum metalizing chamber. Coating in large quantities eliminates the use of more expensive methods.



NEWS of the

ADHESIVES WORLD

2nd Industrial Adhesives Symposium Held at University of Wisconsin

Over 100 persons attended the second annual symposium on Industrial Adhesives Applications, sponsored by the Engineering Institutes of the University of Wisconsin, on October 25 and 26 in Madison, Wisc. Eleven speakers participated in the two-day symposium, which consisted of three sessions—Industrial Adhesives; Structural Adhesives; and Equipment Used for Adhesive Binding. The symposium was opened with a welcome address by Kurt F. Wendt, dean of the College of Engineering at the University of Wisconsin.

Prior to the first session on Industrial Adhesives, Richard M. Blomquist (U.S. Forest Products Laboratory) gave a talk on "Adhesion from a Chemical-Physical Point of View." Mr. Blomquist pointed out that the adhesive industry is one in which it is generally necessary to prescribe or formulate a specific adhesive for a given end use. He explained that this is necessary in order to achieve the proper adhesion to the adherends involved, to provide the necessary working characteristics to make adhesive bonding practical in the plant operations involved, and provide the level of cost and permanence required of the joint. Mr. Blomquist expressed the feeling that we can expect that future efforts to develop new adhesives will involve more of the combinations of the many resins already in use, as well as use of the newer polymers and other materials being continually developed.

Richard A. McCormick (University of Wisconsin) presided over all three symposium sessions as well as serving as moderator of the panel discussion that followed each session.

The subjects and speakers at the first session on Industrial Adhesives were: "Adhesives in the Automotive Industry," by Dr. Sumner B. Twiss (Cycleweld Chemical Products); "Adhesives in the Paper and Packaging Industry," by Murry Funk (Marathon Div. of American Can); Adhesives in the Housing Industry," by Isaac Shepard, Jr. (National Homes); and "Some Practical Applications of Adhesives on Leather, Fibers, and Fabrics," by James F. Eagan (J. E. Milligan).

Dr. Twiss gave broad coverage to the variety of uses of adhesives in the automotive industry. With graphic illustrations, the Cycleweld president showed adhesives being used to adhere brake lining to brake shoes; on car arm rests adhering vinyl covers to board; adhering vinyl interior upholstery to foam cushioning and overhead roofing; in weatherstripping application; gasket sealing; all-round seam sealing; and windshield sealing.

The second speaker, Mr. Funk, explained that adhesives used in the paper and packaging industry must be able to be applied to three systems. According to the senior scien-

The speakers of the Industrial Adhesives session of the Industrial Adhesives Applications symposium, held on October 25-26 in Madison, Wisc. Front row, left to right: Dr. Sumner B. Twiss (Cycleweld Chemical Products); Isaac Sheppard, Jr. (National Homes); James F. Eagan (J. E. Milligan). Back row, left to right: Murray Funk (Marathon Div. of American Can); Richard F. Blomquist (U.S. Forest Products Laboratory); and Richard A. McCormick (University of Wisconsin), institute coordinator.

The speakers of the Equipment Used for Adhesive Binding session of the Industrial Adhesives Applications symposium. Left to right: Richard A. Hufford (Williams, White); Herbert B. Reed (Raybond Electronics); and Karl Brunner (Black Brothers).

tist, these systems consist of the water system, the solvent system, and the hotmelt system. He told of the different adhesive requirements for packaging of different items in a variety of packages. Carton gluing was one of the prime examples given by Mr. Funk. He explained that for some packages the adhesive used must withstand heat and cold, be flexible, and set quickly because of rapid machine operations.

Mr. Sheppard, the third speaker, in his discussion on adhesives in the housing industry, reported that the use of adhesives in this industry generally is on the increase with the most rapid advances taking place in the prefabricated home field. He gave a number of examples of the areas where adhesives are being used in prefabrication, and outlined the different tests made before a particular adhesive was made standard for a particular prefabrication and/or assembly operation.

The final speaker at the first session, Mr. Eagan, told of the different applications of adhesives on leather, fibers, and fabrics. He explained that adhesives used in leather application, primarily in the shoe manufacturing industry, fall into two application classes—temporary and permanent. These adhesives, he added, are most often applied by roller coating and brush. In applications on fiber materials, the general manager of J. E. Milligan pointed out that fibers being either natural or synthetic require different adhesives. In addition, consideration must be given to the type of material the fiber is to be adhered to. He stated that fabrics have somewhat similar adhesive requirements.

The panel of speakers of the Structural Adhesives session of the Industrial Adhesives Applications symposium. Left to right: M. L. Selbo (U.S. Forest Products Laboratory); Albert F. Martin (Minnesota Mining & Mfg.); Paul H. McCormack (National Starch & Chemical); and Robert E. Parkinson (U.S. Steel).

Four speakers also participated in the second session on Structural Adhesives. The speakers and their subjects were: "Structural Lamination," M. L. Selbo (U.S. Forest Products Laboratory); "Curtain Wall Construction," Robert E. Parkinson (U.S. Steel); "Metal Assemblies," Albert F. Martin (Minnesota Mining & Mfg.); and "Particleboard Binders," Paul H. McCormack (National Starch & Chemical).

Mr. Selbo pointed out that there are so many types and classes of adhesives now available as to make proper selection difficult. However, he explained, in the wood industry two types adhesives are used for structural wood laminates—natural glues and synthetic chemical adhesives. According to Mr. Selbo, laminators call casein glue the work horse of the industry, and he attributes its usage to the fact that it is less expensive than the phenol-resorcinol types and gives more than adequate laminates.

Structural Adhesives

The next speaker, Mr. Parkinson, in his discussion of structural adhesives for curtain wall construction, stated that the selection of adhesives for architectural panels is very important because they are a vital part of an expensive structure that must have a life of many years. According to Mr. Parkinson the five important factors that must be considered in the selection of curtain wall adhesives are: (1) strength requirement; (2) permanence and durabiliy; (3) processing convenience; (4) economy; and (5) adaptability and compatability of the adhesive for use with other components of the particular sandwich panel.

In his presentation on adhesives used in metal assemblies, the third speaker, Mr. Martin, stressed that the basic requirement for adhesive use is to design parts so all of the bonded areas carries the load at the same time. Beyond that, he added, adhesive properties and fabrication method must be considered. He remarked that fabrication involves three steps: surface preparation; adhesive application; and curing, and all three must be specified to obtain the desired performance at lowest cost and minimum fabricating time.

The final speaker at the second session, Mr. McCormack, described the manufacturing process of particleboard by means of an illustrative flow chart. He stated that the adhe-

sive binders used in particleboard manufacture are of the synthetic chemical types such as urea-formaldehyde and phenol-formaldehyde. He discussed the advantages and disadvantages of each binder and pointed out that particleboards using urea-formaldehyde adhesives are limited to interior use.

The symposium's final session on equipment used for adhesive binding consisted of three speakers, they were: Karl Brunner (Black Brothers) who discussed "Spreaders"; Richard A. Hufford (Williams, White & Co.) who spoke about "Presses"; and Herbert B. Reed (Raybond Electronics) whose subject was "High Frequency Curing."

Mr. Brunner's talk dealt almost exclusively with roller coating type machines. He traced the history of glue spreaders and linked their development with the development of new adhesives and bonding techniques. Mr. Brunner explained that the selection of a spreader depends on such factors as the style of joint, the material to be joined, and the kind of adhesive to be used.

The second speaker, Mr. Hufford, in his presentation on presses, first described the applications and control of hydraulic presses used mainly in the plywood and particleboard industries. He discussed the nomenclature of a number of presses in use by the industries as well as the nature of their installation.

In his talk on high frequency curing, the final speaker, Mr. Reed, stated that if we could raise the temperature of a urea-formaldehyde glue line we could have a rapid curing time. However, he pointed out that many of the materials being bonded, by applying heat at the glue line, are poor conductors of heat. According to Mr. Reed, the problem of adhesive curing by high frequency methods, was to develop a frequency that will effect a cure of the adhesive without destroying or damaging the material to be bonded. He went on to describe several high frequency curing units and systems and in what applications they are being used.

ADM Sells Division

Archer-Daniels-Midland Co., Minneapolis, Minn., has completed the sale of its Crosby Aeromarine Division to Continental Fiberglas Corp., Cheyenne, Wyo., for an undisclosed amount. The sale includes two plants, one in Grabill, Ind., and the other in Donaldsonville, Ga.

Elect New ASTM D-14 Officers

Dr. Alan A. Marra was unanimously elected chairman of ASTM's Committee D-14 on Adhesives at the group's October 13-14 meeting in Chicago, Ill. An associate professor in the University of Michigan's School of Natural Resources, Dr. Marra succeeds the late Dr. John E. Rutzler, Jr.

At the same meeting, held in the Del Prado Hotel, Nicholas J. DeLollis was unanimously elected to take over Dr. Marra's former office as vice-chairman of the D-14 Committee. Mr. DeLollis is a materials engineer for Sandia Corp., Sandia Base, Albuquerque, N.M.

Dr. Rutzler, an associate professor in physical chemistry at Case Institute of Technology, Cleveland, Ohio, suffered a heart attack in Erie, Penna., on October 10, 1960. He was stricken and died minutes after concluding a talk before a meeting of the Rubber and Plastics Division of the American Society of Mechanical Engineers.

At the business meeting of the D-14 Committee, members passed a resolution officially recognizing "the loss of a personal friend and devoted scientist." In addition, a letter of condolence was sent to Dr. Rutzler's widow who lives in Cleveland Heights, Ohio.

Dr. A. A. Marra

N. J. DeLollis

Devcon Studies Repairs

A study of specific repairs, with emphasis on the heavy marine field, has been completed by Devcon Corp., Danvers, Mass. The company points out that the findings are applicable to all industry as the equipment under consideration is often identical to that used in factories and elsewhere. Free copies of the report, "Plastic Steel and Other Devcon Products for Heavy Duty Marine Repairs" are available from Devcon.

Avery Opens New Plant

The 13th Avery Label Co. facility to be built in the United States and overseas has begun operations in North Brunswick, N. J. The new plant, which will manufacture pressure-sensitive labels, replaces one opened during 1956, and is expected to expand Avery's ability to meet eastern demand for pressure-sensitive labels, the company states.

Water-Based Adhesive

Development of Polygriptex, described as an improved, water-based adhesive for bonding polyethylene and polypropylene sheeting to kraft paper and burlap in the manufacture of multiwall bags, has been announced by Adhesive Products Corp., New York, N.Y. Designed for high speed production on existing packaging equipment, the product is said to form a strong, permanently-flexible bond which will withstand shock and extremes of temperature. Polygriptex is a non-inflammable, free-flowing cement which requires no heating or catalytic agents to facilitate drying. The adhesive is fast-grabbing to speed production and dries transparent with no residual odor, it is said. The manufacturer recommends it for adhering various films to waxed surface packages; also for adhering paper labels to flexible, semi-flexible and rigid polyethylene and polypropylene containers. Several viscosities are available.

New Ciba Products

Ciba Products Corp., Fair Lawn, N. J., has developed three new products for epoxy use, Araldite DP-116, DP-121, and Araldite 7072. Araldite DP-116, a curing agent for epoxy resins, is said to cure at room temperature in 45 seconds to five minutes depending on thickness of sample. According to Ciba, the hardener is particularly suitable for structural and electrical repair kits, laminating and gel coats, fast curing traffic paints, and adhesives for traffic bars and reflectors.

A longer pot life than other low viscosity curing agents is one of the main features of Araldite DP-121, the company states. It is said to cure 2 to 3 days after mixing with conventional liquid epoxy resins. Films of 5 to 10 mils can be applied in a single spray coat and systems cured with DP-121 result in hard, tough, flexible films possessing good chemical resistance, the company claims.

Recommended for use in adhesives, laminating, and surface coatings, Araldite 7072 is an epoxy resin designed to eliminate sintering and fusing during storage. According to Ciba, the resin is produced through a unique process which permits close control of molecular distribution resulting in narrower specifications, lower surface tension of vehicles, improved solubility, and better clarity.

Flintkote Quarter Report

During the quarter ended September 30, Flintkote Co., New York, N.Y., reported a net income of $5,185,041, or 86¢ a share, compared to $6,030,057, or $1.02, for the same quarter of 1959. Net sales were up slightly, to $73,059,499, from $72,824,334 for the 1959 quarter. Net income for the nine-month period ending September 30, dipped to $10,841,307, or $1.72 per share, from $13,434,922, or $2.20, for the comparable period of 1959.

Joins Schenectady

George Brannick, Jr. has joined Schenectady Varnish Co., Inc., Schenectady, N. Y., as a research chemist, and will direct research and development in resins for bonded and coated abrasives in his new post. He will be located at the company's main office. Mr. Brannick was formerly affiliated with Varcum Chemicals and the Sterling Grinding Wheel Co.

3M Financial Statement

Herbert P. Buetow, president of Minnesota Mining and Manufacturing Co., St. Paul Minn., has predicted record sales and earnings for the company's fourth quarter, as sales for the third quarter reached the level of $140,133,725, highest in the company's history. The figure compared to $125,973,824 in the like 1959 period. Net income increased to $17,768,363, or 35 cents a share, from $16,101,243, or 32 cents a share. Nine month net was $50,134,365, equal to 98 cents a share, on sales of $403,146,898. In the comparable 1959 months, sales were $363,332,469 and net was $5,698,317, or 89 cents a share. Figures for 1959 are adjusted to reflect foreign operations which until this year were not included in the company's consolidated reports. Share earnings also are adjusted to reflect a three-for-one stock split in May.

U.S. Rubber Bondant

U.S. Rubber Co., New York, N. Y., has developed M-6479 Adhesive, a new product for bonding sections of latex or polyurethane foam rubber, and suggested by the company for the manufacture of cushioned furniture. The clear, neoprene-based adhesive is said to form a joint which, when completely dry, is stronger than the parent foam material. The special formulation calls for a delayed setting time, and affords a dimple-free bond when only a slight pressure is used to make the joint, according to U. S. Rubber.

"After laboring all day over a hot Bunsen burner, testing polyvinyl acetate resins, polyvinyl butyral resins, film forming resins, waxes, pigments, dyes, fillers and stabilizers, I don't particularly care to be greeted at the door with—How did things go at the 'Glue Factory' dear?"

Fasson Ups Capacity

A block-long coating and laminating machine, said to be capable of applying coatings and backing papers to a virtually unlimited variety of materials, has been put into operation at Fasson Products, Painesville, Ohio. Installed in a new 18,000 square foot extension to the plant area, the machine is rated at the highest production capacity for a single device in the nation. It is said to coat a maximum size web of 56 inches at speeds in excess of 200 feet per minute. According to William R. Zimmerman, vice-president and general manager of Fasson, the machine can handle such materials as papers, films, foils, and acetates, which are converted to self-adhesive signs, decorative trim and other graphic arts and industrial products. Mr. Zimmerman states that with the addition of the machine, Fasson has now doubled its plant capacity and can place into actual production several developments presently under test in its research and development facilities.

Monroe Develops Pliocon

Pliocon, a clear liquid concrete floor treatment formulated with Goodyear Tire and Rubber Co.'s Pliolite S-5, has been developed by the Monroe Co., Cleveland, Ohio, for application on new or old concrete surfaces. The liquid is recommended by its manufacturer for sealing, hardening and dustproofing concrete surfaces in packing plants, dairies, breweries, chemical plants, and other such buildings. It is said to resist damage from water, oils and acids, while reducing maintenance costs and extending the life of the concrete surface.

Bemis Plans Expansion

A plant expansion and modernization program totaling more than $1,200,000 has been announced by Judson Bemis, president of Bemis Bro. Bag Co., St. Louis, Mo. Principal features of the program include a new plant near Muskegon, Mich., for the manufacture of Temkold, and plant expansions in St. Louis, Mo., Claremont, N. H., Flemington, N. J., and Vancouver, Wash. According to Mr. Bemis, about half of the total expenditures will be devoted to new papermaking and bag converting equipment installations in these locations.

Cyanamid and Hooker Deny Monopoly Charge

American Cyanamid Co. and Hooker Chemical Co., both of New York, N.Y., prepared to battle Federal Trade Commission charges of monopoly, restraint of trade, and illegal acquisition, as the Justice Department launched its fourth and fifth major suits against chemical manufacturers in the past two years. Cyanamid was quick to enter its protests with the statement "We are confident that all of our activities in this area have been lawful and we propose to defend our position vigorously."

The reply was in response to charges issued by Attorney General William Rogers and his assistant, Robert Bicks, that for the past 23 years Cyanamid has been using its patents, its know-how, and its position as a basic producer of dicyandiamide, melamine and melamine products to ward off competition in this field in the U.S. The civil antitrust complaint holds that Cyanamid violated the Sherman and Clayton Acts through the acquisition of two producers of melamine-based end-products—Formica Co. and Panelyte Division of St. Regis Paper Co.—and through an illegal agreement with six other firms to restrain and monopolize interstate and international trade in melamine and melamine products. The six firms, cited as co-conspirators, but not as defendants, are: Monsanto Chemical, Ciba Ltd., Ciba Products Corp., British Industrial Plastics, Societé des Produits Azotes, and British Oxygen Co.

Cites Formica

The Justice Department has asked the federal district court in New York to order Cyanamid to dispose of its Formica and Panelyte acquisitions. In addition, they ask that Cyanamid be prohibited to refuse to sell dicyandiamide, melamine or melamine products to anyone willing to purchase them at reasonable prices; also, they ask a broad degree forbidding any "continued" attempt to restrain trade in the melamine line; finally, that Cyanamid be enjoined from continuing to produce or sell melamine or melamine products.

Hooker Chemical Co. has denied FTC charges that it illegally acquired Durez Plastics and Chemicals Inc., North Tonawanda, N.Y., and certain assets of Monsanto Chemical Co., St. Louis, Mo. The complaint said that Hooker produced no phenolic molding materials prior to 1955, but became a major factor in the industry by acquiring Durez—then the nation's largest producer—in that year. Since the Durez acquisition, the FTC said, two significant producers (Monsanto and Borden) have withdrawn from the industry and there have been no new entries.

Hooker has requested that the FTC dismiss its charges, stating that the acquisition did not lessen competition in the output and sales of phenolic molding materials and in the general purpose, electrical, impact and heat-resistant lines of these materials, and further stating that it is "relatively easy" for anyone to get into the plastics industry "due to the low capital requirements, availability of know-how, absence of patents or trade secrets and general knowledge of the identity of users of such molding compounds. On information and belief," the statement continued, "since 1949 eight companies have entered the said business and Reichhold Chemicals, Inc., is presently constructing facilities for the manufacture of phenolic molding compounds."

Norman Haber

Named Representative

American Mineral Spirits Co., Chicago, Ill., has appointed Norman Haber as its technical representative to handle the firm's line of solvents and chemicals in the New York and New Jersey areas. Mr. Haber, a graduate of City College of New York with a M.S. degree in chemical engineering, previously had served 13 years as paint plant manager for Paragon Paint & Varnish Co. He also had been associated with T. J. Ronan Co., as its technical director.

High Plastics Potential Seen at SPI Meeting

Those attending the annual meeting of the New England section of the Society of the Plastics Industry at Portsmouth, N.H., heard a Borden executive speak of growing potential for plastics both in the building and frozen foods industries, and were warned by an SPI official of a need for tariff protection. Augustine R. Marusi, president of the Borden Chemical Co., New York, N.Y., said that the market offering the greatest promise for the future of the plastics industry is building, stating that while building is a $50 billion a year business now, it could well be a $75 billion business by 1970. "Yet, it is estimated that plastics' share of the building industry is only 1 to 2 per cent," he continued. "If we could boost that share to, say, 10 per cent within the next ten years—a not unreasonable hope—the dollar value of plastics for building use alone would exceed by almost half the total sales of the entire plastics industry today."

Mr. Marusi also saw promise of growing demand for plastics in frozen foods packaging and in the household appliance field. He pointed out that the demand for polyethylene and polypropylene film for "boil-in-a-bag" foods is expected to triple in the next five years, rising from 100 million to 300 million units. In addition, he foresaw not only an increase in appliance sales, but a higher proportion of plastics used in the appliances of the next decade.

Threat of Imports

William T. Cruse, executive vice-president of the SPI, also a speaker at the meeting, discussed the threat of an upsurge in imports, and urged remedial legislation. He cited the instance of the sharp growth of vinyl film raincoat imports from Japan, which rose 764 per cent in 1959 over 1958. From a moderate 9.5 per cent of the total U.S. market in 1958, vinyl coat imports soared to 51 per cent of the market in 1959. Imports during the first quarter of 1960 registered a 3,400 per cent increase over the first quarter of 1958 and a 35 per cent increase over the first quarter of last year, Mr. Cruse said. He called for adequate tariff protection for the plastics industry, going on to mention, however, that there is little trade potential for plastics in the European Common Market or the European Free trade area.

Le Page Reports Profit

The Le Page subsidiary of Papercraft Corp., Pittsburgh, Penna., which operated at a loss in 1959 as a division of Johnson & Johnson, is returning a good profit, according to J. M. Katz, president and chairman of Papercraft. Mr. Katz told the Pittsburgh Society of Financial Analysts that Le Page began making a profit within 30 days after its May acquisition, and that in August, the latest month for which figures are available, Le Page had a volume of $420,000, and a pretax profit of $82,000. He said that the August volume was less than the monthly volume Le Page averaged in 1959, when it had annual sales of about $7 million, but that this was largely attributable to the weeding out of unprofitable products.

Le Page's Gloucester, Mass., plant is equipped to handle a $13.5 million volume annually, according to Mr. Katz, and at some point in the future, sales of the subsidiary "could reach $25 million." The company plans to set up a plant in Italy for the manufacture of gift wrapping paper, controlled by a Swiss holding company which would be wholly owned by Papercraft.

Named by National Starch

Richard W. Reiter has been promoted to the post of laboratory manager of the Resin Development Group of the Resin Division of National Starch and Chemical Corp., New York, N.Y. Mr. Reiter, a graduate of Wheaton College, was formerly in charge of product applications development for the Resin Research Group. In his new position he will continue to direct phases of this work and will, in addition, be responsible for development and service work in the paint, coatings, binders, and other resin markets.

Permacel Displays Line

Permacel, New Brunswick, N. J., will feature several new products at its display at the National Conference on the Application of Electrical Insulation, to be held on December 5 to 8 at the Conrad Hilton Hotel in Chicago, Ill. The new products to be featured include: Permacel Flat Conductor Cable; EE 6100 Hi-Temp Reflective Tape; and EE 4716 Polyester Mylar Film Cable Wrapping Tape. In addition, the company will display its line of epoxy resin coatings, Teflon tapes, silicone rubber tapes and 2-in-1 electrical tapes.

Adhesives Firm Formed

International Coatings Co., Compton, Calif., specializing in adhesives and coatings, printing inks, and plastisols has recently been formed. According to reports, in the adhesives field the firm will supply heat seal and wet stick adhesives for paper bags, aluminum foil and paper boxes, as well as adhesives for a variety of plastic products. The company will also formulate coatings for paper for packaging; coatings for aluminum, fabrics, acetate, vinyl and other films; and spray coatings for refurbishing vinyl furniture.

Herb Wells has been named general manager of International Coatings, and Al Isenberg is technical director. Both men have had over 15 years experience in the fields to be serviced by the firm. Claude Johnson, with over 10 years experience in adhesives and coatings, will handle sales for the new company.

Rubber Separating Paper

Riegel Paper Corp., New York, N. Y., has announced the introduction of a new interleaving and separating paper called Strip-Ease. It is a silicone coated kraft that the company claims will not stick to tacky rubber, pitch, asphalt, plastic compounds, and similar materials. It is said to be durable enough to permit multiple-reuse in many rubber processing applications.

Permacel Names Budge

L. B. Budge has been appointed manager of the Central Electrical Division of Permacel, New Brunswick, N.J. A graduate of Kenyon College, Gambier, Ohio, Mr. Budge joined Johnson & Johnson, the parent company, in 1950 as a sales representative. He became an electrical sales representative at Permacel in 1956. He has served as electrical field manager in the Midwest area since January.

J & J to Acquire Site

Johnson & Johnson, New Brunswick, N.J., will acquire a 455 acre site in Sherman, Texas, on which it plans to construct a plant to replace outgrown facilities on an 11 acre site in Dallas. The company is already considering offers for the Dallas plant, although it reports that it will continue to operate the 180,000 square foot plant, which makes surgical dressings and baby products.

Borden Earnings Up

Borden Co., New York, N. Y., reports that its sales and earnings for the first nine months of 1960 and for the third quarter of 1960 were up over those of last year. Sales for the first nine months of 1960 were $713,241,960, up 2.2 per cent from the comparable $698,059,820 figure for 1959. Nine-month earnings were $20,759,258, up 9.1 per cent from the 1959 figure of $19,033,584. Earnings per share were $2.09. This compares after adjustment for a two-for-one stock split in January 1960, with $1.93 for the nine-month period of 1959.

The 1960 third quarter sales were $241,754,600, up slightly from the $241,606,664 of the 1959 third quarter. Earnings for the period were $7,365,100, up 3.7 per cent for the year earlier figure of $7,100,678. Third quarter earnings per share were 74¢, which compares, after the split adjustment, with 72¢ in the 1959 third quarter.

TAPPI Holds Meeting

Eighteen papers and a panel discussion, devoted to all major aspects of research on plastic-coated, plastic-impregnated, and laminated papers and paper products, made up the technical program of the 15th Plastics-Paper Conference of the Technical Association of the Pulp and Paper Industry, which was held on October 17 to 19 at the Hotel Syracuse in Syracuse, N. Y. The conference was sponsored by the TAPPI Converting and Consuming Division, which is composed of the Plastics, Plastics Laminates, and Wet Strength and Interfiber Bonding Committees of the association. In addition, the program included two field trips, one to the Dilts Division of Black-Clawson Co., in Fulton, N. Y., and the other to New York State University's College of Forestry in Syracuse.

Packaging Corp. Report

Packaging Corp. of America and its consolidated subsidiaries reported a net income after taxes, for the fiscal year ended June 30, of $6,510,715, equal to $1.64 per common share, compared to $6,528,183, also $1.64, for the previous fiscal year. Last year's figure represents a combined total for three companies prior to their merger. Net sales for the present year rose to $138,278,790, from the $126,094,462 achieved for the fiscal year ended June 30, 1959.

Defends Patent System

In a speech delivered at the Technical Forum Days of the Minnesota Mining and Manufacturing Co., St. Paul, Minn., held October 17 to 19, Dr. Carl E. Barnes attacked critics of the patent system who have recently reported to the Senate subcommittee on patents, trademarks, and copyrights. In addition to defending the patent system as a necessary incentive for research and development, Dr. Barnes went on to say that the burden of removal of patent rights would fall even more heavily on small companies than it has on the giants stripped of patent rights by anti-trust actions. "Without protection, there would be little point in extensive development, and even less in process disclosure . . . " he commented.

In discussing bills in Congress aimed at changing the policy of ownership of patent rights in conjunction with government-sponsored research contracts, he pointed out that a company taking a government research contract "is expected to utilize equipment, experienced research personnel . . . and to utilize its proprietary technical knowledge in carrying out this research. In order to justify such diversion of the use of its staff, it needs the incentive of being able to retain any commercial rights which may possibly result from this research."

Container Nine Months

Net income after taxes for the nine months ended September 30 for Container Corp. of America, Chicago, Ill., was $14,076,000, equal to $1.31 per share, compared to $14,609,000, or $1.36, for the comparable period of 1959. Sales for the period rose slightly over last year's, to $245,544,000, from $240,896,000. Net income after taxes for the third quarter was $4,180,000, or 39¢, compared to $4,984,000, or 46¢ for the like period last year, and sales of $85,035,000 compared to sales of $85,000,000. Last year's figures were restated by the company to include foreign subsidiaries.

Hayes Bought by Spinks

Hayes Adhesives Co., St. Louis, Mo., has been purchased by H. C. Spinks Clay Co., Paris, Tenn. Hayes will be operated as a new manufacturing and marketing division under Spinks management, and will have increased personnel and equipment.

Building Show Planned

More than 10,000 top industrial executives, plant engineers, architects, and consultants are expected to attend the Industrial Building Exposition & Congress on December 12 to 15 at the New York Coliseum in New York City. According to Clapp & Poliak, Inc., New York, N. Y., producer of the event, the exposition and concurrent congress is directed at an audience drawn from all of industry—those interested in building new facilities or modernizing existing plants. The exposition will contain displays by more than 115 companies, and more than 1,000 experts will be on hand to answer questions. At the congress, 61 speakers, representing virtually every type of company presently engaged in plant expansion or modernization, will explain how their own companies tackle the problem of adding to their facilities in new locations or old. Persons who want to visit the exposition and congress, or obtain additional information, should contact Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Monsanto to Expand

A new plant, slated for the Texas City, Texas, area, will boost phenol production of Monsanto Chemical Co., St. Louis, Mo., by 50 to 75 million pounds per year. Scheduled to be on stream early in 1962, the plant will raise the company's total capacity to more than 200 million pounds per year. The main reason for the expansion is the company's growing production of phenol derivatives such as aspirin, alkyl phenols, bisphenol A, and others. The cumene-oxidation route will be used in production, as Monsanto will utilize the by-product acetone.

3M Surgical Products

The marketing of a surgical tape and two types of surgical masks has been announced by Minnesota Mining & Maufacturing Co., St. Paul, Minn., six weeks after the company revealed that it would merge with Warner-Lambert Pharmaceutical, Morris Plains, N.Y. Scotch Brand Microporous Surgical Tape No. 530 is said to feature a nonwoven backing material that "breathes," and a unique microporous adhesive made of a single chemical. According to the company the tape offers "almost complete" relief from skin irritations, enough transparency to allow observation of the wound as it heals, no fogging of x-ray plates, and painless removal.

The two masks, 3M Hospital Mask No. 8300 and Scotch Brand Surgical Mask No. 540, are made in one size, to fit any face, and are disposable. The hospital mask is a lightweight, nonwoven, form-fitted fabric, 99.4 per cent efficient as a bacterial filter, while the surgical mask is a thin flexible plastic with a built-in non-woven filter which filters 90 per cent of the bacteria in a stream of air even after 30 minutes of testing, it is reported.

Kania Promoted

Walter Kania, an expert in the field of wood adhesion, has been promoted to senior development chemist in the Structural Products Group of National Starch & Chemical Corp., New York, N. Y. He will continue to make his headquarters at the firm's Alexander Research Laboratories in Plainfield, N. J. Mr. Kania holds a B.S. degree in chemistry from New York University and an M.S. degree in chemical engineering from Newark College of Engineering.

"Are you sure about that one minute drying time?"

names in the news

Stafford L. Hopwood, Jr., has been named assistant manager of the Central Chemical Development Department of Food Machinery & Chemical Corp., New York, N.Y.

Albert L. Munsell has been named general sales manager for Formica Corp., Cincinnati, Ohio. **Joseph H. White,** previously district manager at Pittsburgh, Penna., succeeds Mr. Munsell as sales training director, and **Robert E. Hughes** succeeds Mr. White.

Edward Rauh, sales representative for Colton Chemical Co. in Ohio, Michigan, and Indiana, has been transferred to California and will be headquartered in Los Angeles.

L. J. Hickey has been named senior development engineer in the Paper Converting Group at National Starch & Chemical Corp., Plainfield, N.J.

Dr. Marvin W. Sage has been appointed technical director of Hodag Chemical Corp., Skokie, Ill.

Robert L. Schwan has joined Schenectady Varnish Co., Inc., Schenectady, N.Y., as product sales manager.

Carl E. Druggs has been named works manager of the Compton, Calif., plant of Borden Chemical Co.

Dr. Cataldo Ciadella, previously director of research, has been appointed director of research and development for Hysol Corp., Olean, N.Y., and **James Hornburg** has been named supervisor of technical services.

Wyman L. Taylor, formerly western sales manager, has been named assistant to the vice-president, sales for the Industrial Chemicals Division of Stauffer Chemical Co., New York, N.Y

Marion F. Smith has been appointed chief chemist in charge of research for Asbestos Bonding Corp., Napa, Calif.

Dr. William von Fischer has resigned as vice-president of research for Glidden Co., Cleveland, Ohio, to devote his time to private consulting.

Kenneth Hadley has joined Crown Zellerbach Corp., Camas, Wash., as associate chemist in the Central Research Department.

Dr. John M. Kolyer has joined Food Machinery & Chemical Corp., as a research chemist in the Princeton, N.J., central research laboratory.

Paul E. Doucette, previously with Electric Autolite Co., has joined Hysol Corp., Olean, N.Y., and is in charge of the product development program on molding and pelletizing powders.

Duke Witherow, previously products manager for the Electronic Division of Coast Pro-Seal & Mfg. Co., Los Angeles, Calif., has been named sales manager of the Chemical Division.

Earl R. Peterson has been appointed sales manager for the Western Division of Taylor Fibre Co., LaVerne, Calif.

Paul J. McGonigal has been named research chemist at the Philadelphia, Penna., central research laboratory of Borden Chemical Co.

Russell H. Bellew has joined the Coatings Department of Goodyear Tire & Rubber Co., Akron, Ohio, as a sales engineer.

Arnold O. Beckman, president of Beckman Instruments, Inc., Fullerton, Calif., has been given the Illini Achievement Award for "leadership in the field of precision instruments."

Chris Johnson has been named to head the newly-formed Oxiron Application Group at the Princeton, N.J., research and development center of Food Machinery & Chemical Corp. **Charles Cullen, Norbert Talbert, John Rizzo, Fred Lister,** and **Murray Reich** have joined the group.

Thomas L. Eagen has been named manager, contract sales for Formica Corp., Cincinnati, Ohio, **Robert H. Cottle** has been appointed western sales manager for the firm, and **Edward P. Borchers** succeeds Mr. Cottle as Los Angeles district manager.

Wayland P. Morse, general purchasing manager for Borden Co., New York, N.Y., celebrated his 50th anniversary with the company.

Richard G. Allen, previously with Ohio Boxboard Co., has joined Packaging Corp. of America, Quincy, Ill., as a chemist.

John Delmonte, general manager of Furane Plastics, Inc., Los Angeles, Calif., has been elected vice-president, administration, of the Society of Plastics Engineers.

Dr. Hubert R. Snoke, assistant chief of the Building Technology Division and chief of the Floor, Roof and Wall Covering Section of the National Bureau of Standards, Washington, D.C., has retired after 40 years of service.

William E. Donovan has been appointed district sales manager for the Fasson Products Division of Avery Adhesive Products, Inc., Painesville, Ohio.

Alvin E. Jerome has been named sales representative for the Polyco-Monomer Department of Borden Chemical Co., New York, N.Y.

Roman G. Martin, Jr., has been named associate development chemist in the paper laboratory of A. E. Staley Mfg. Co., Decatur, Ill.

William A. Maggio, previously with Rhinelander Paper Co., has joined Armstrong Cork Co., Lancaster, Penna., as a research chemist.

Drs. John Ager, Jr., and **William L. Riedeman** have joined the Organic Department at the Princeton, N.J., chemical research and development center of Food Machinery & Chemical Corp.

Donald M. Alstadt has been named vice-president of Hughson Chemical Co., Erie, Penna.

Robert E. Attig has joined the Sales Department of Shawinigan Resins Corp., Springfield, Mass., as a sales trainee.

Dr. Anthony T. Coscia has been named group leader of a newly-formed organic chemistry group on paper chemicals research in the Industrial Chemicals Division of American Cyanamid Co., New York, N.Y.

Arthur E. Irvine has been appointed market manager for flexible packaging materials for Union Carbide Plastics Co., New York, N.Y.

Christmas Greetings 1960
FIGHT
TB
WITH
CHRISTMAS
SEALS
ANSWER YOUR CHRISTMAS
SEAL LETTER TODAY

Dec. 1-2. Rubber & Plastic Adhesive & Sealant Manufacturers Council, Winter Meeting, Edgewater Beach Hotel, Chicago, Ill.

Dec. 3-9. Chemical Specialties Manufacturers Association, 47th Annual Meeting, Hollywood Beach Hotel, Hollywood, Fla.

Dec. 4-7. American Institute of Chemical Engineers, Statler Hotel, Washington, D.C.

Dec. 5-8. Third National Conference on the Application of Electrical Insulation, Conrad Hilton Hotel, Chicago, Ill.

Dec. 8. Synthetic Organic Chemical Manufacturers Association, Annual Meeting, Roosevelt Hotel, New York, N.Y.

Dec. 11-14. American Nuclear Society, Mark Hopkins Hotel, San Francisco, Calif.

Dec. 12-15. Industrial Building Exposition and Congress, New York Coliseum, New York, N.Y.

Dec. 26-31. American Association for the Advancement of Science, Annual Meeting, New York, N.Y.

Jan. 9-11. National Symposium on Reliability and Quality Control, Bellevue Stratford Hotel, Philadelphia, Penna.

Jan. 16-19. Instrument Society of America, Winter Instrument-Automation Exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis, Mo.

Jan. 24-27. Society of Plastics Engineers, 17th Annual Technical Conference, Shoreham Hotel, Washington, D.C.

Jan. 26-27. Engineering Institutes on Nondestructive Testing, University of Wisconsin, Madison, Wisc.

Jan. 30-Feb. 2. Plant Maintenance and Engineering Show, International Amphitheatre, Chicago, Ill.

Jan. 30-Feb. 3. American Society for Testing Materials, Committee Week, Netherland Hilton Hotel, Cincinnati, Ohio.

Feb. 7-9. Society of the Plastics Industry, 16th Reinforced Plastics Division Conference, Edgewater Beach Hotel, Chicago, Ill.

Feb. 9-10. Engineering Institutes on Packaging Industrial Products, University of Wisconsin, Madison, Wisc.

Feb. 9-11. Fifth Annual Home Improvement Products Show, New York Coliseum, New York, N.Y.

Feb. 13-17. American Management Association, Packaging Management Course, Hotel Astor, New York, N.Y.

Feb. 19-23. Technical Association of the Pulp & Paper Industry, 46th Annual Meeting, Commodore Hotel, New York, N.Y.

Feb. 20-23. American Pulp and Paper Association, Annual Convention, Waldorf-Astoria Hotel, New York, N.Y.

Feb. 22-24. Material Handling Institute, Pacific Coast Show, Cow Palace, San Francisco, Calif.

Feb. 23-24. Chemical Institute of Canada, Protective Coatings Division Conference, Toronto, Ontario, Canada.

Feb. 26-Mar. 1. American Institute of Chemical Engineers, National Meeting, New Orleans, La.

Portrait Of

GEORGE T. BUTTS

As supervisor of Adhesive Technical Service, Colton Chemical Co., Cleveland, Ohio, George T. Butts spends about a fourth of his time visiting the laboratories and plants of adhesive manufacturers across the country. His trips generally lead to special research and development projects which he sets up and directs at the Colton laboratory.

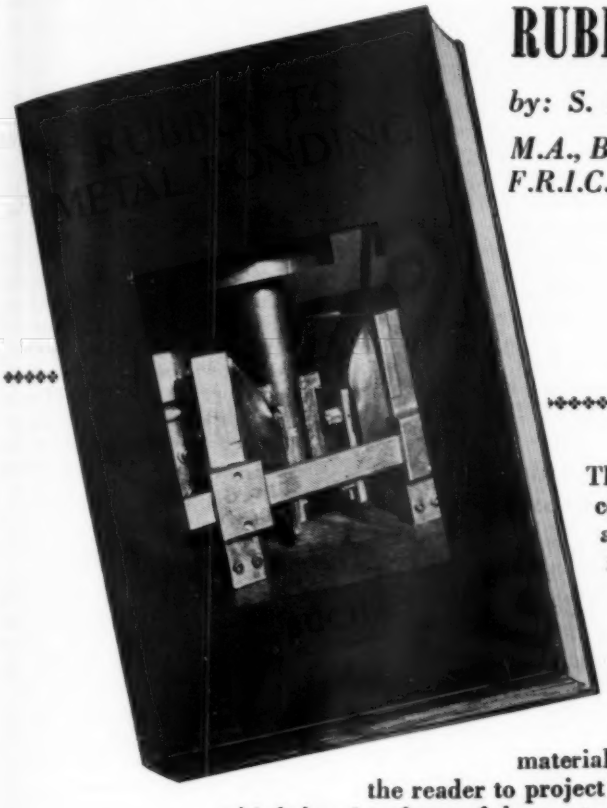
Mr. Butts joined Colton, a division of Air Reduction Co., Inc., in 1953 after graduating from the University of Oklahoma with a bachelor of science degree in chemistry. Most of his work has centered around the development of emulsion polymers and their application in adhesive formulations.

His extensive work on copolymers of polyvinyl acetate formed the background for a technical article in ADHESIVES AGE, October, 1959. Currently, he is working on the relation to adhesion of comonomers of polyvinyl acetate and various protective colloids.

Close liaison with adhesive manufacturers is necessary, Mr. Butts explains, to make sure that Colton research and development studies meet the needs of regular adhesives plant production, and satisfy the demands of the adhesives user.

Mr. Butts is a member of TAPPI, the Forest Products Research Society, the ACS, and the ASTM Committee D-14 on Adhesives.

NOW AVAILABLE



A new fully revised and up-dated edition of

RUBBER TO METAL BONDING

by: S. Buchan

M.A., B.Sc. (Aber.), Ph.D. (Cantab), F.R.I.C., A.I.R.I.

1959, 296 pages, with bibliography

$7.50

This new edition of Dr. Buchan's important and comprehensive work, has been completely revised and up-dated to include the many advances and new developments in the technology of bonding rubber-to-metal in the 10 years since the publication, in 1948, of the widely-acclaimed original edition. Describes processes, applications and methods in detail. Gives concise, straight-forward explanations of how to handle rubber-to-metal bonds at each stage of the job. Sufficient materials are included with each description to permit the reader to project given examples to his own needs. Written by the chief chemist of one of the most successful bonding firms in the world, this is the single most complete source of information about a subject of major technical importance to men working in the rubber adhesive industries.

CONTENTS:

Introduction
Plating Plant
Cleaning Solutions
Brass-Plating Solutions
Methods of Analyses
Electro-Plating
Processing and Process Control
Natural Rubber Compounding
Synthetic Rubber Compounding
Molds and Molding (38)
Physical Examination of Brass Deposits
Chemical Examination of the Rubber-to-Brass Bond
Properties of the Rubber-to-Brass Bond
Bonding Agents, Thermoplastic
Bonding Agents, Halogenated Rubber Derivatives
Bonding Agents, Polyisocyanates
Bonding Agents, Various
Bonding Vulcanized Rubbers
Testing Bonded Units
The Nature of the Rubber-to-Metal Bond
The Importance of Design

DISTRIBUTED EXCLUSIVELY IN THE U.S. AND CANADA BY

PALMERTON PUBLISHING COMPANY,

101 West 31st Street, New York, N. Y.

Use Coupon to order

Palmerton Publishing Co., Inc.
101 West 31st Street
New York, N. Y.

Gentlemen: Please send ..... copies of Rubber to Metal Bonding

For all books destined for foreign delivery, add 50¢ per copy for postage and handling.

☐ check is enclosed ☐ bill me with order

Name .....

Address .....

City ..... Zone.... State .....

Sales and Earnings Up

National Starch & Chemical Corp., New York, N. Y., reports an increase in its sales and earnings for the nine-month period and third quarter ended September 30. Net sales for the first nine months of 1960 amounted to $41,091,152, compared with the 1959 figure of $39,224,985. Net income after taxes in the 1960 period totaled $2,362,074, equal to common share earnings of $1.15. This compares with the like 1959-period figure of $2,287,894, equal to $1.13 per share.

Net sales in the third quarter of 1960 totaled $13,607,567, compared with $13,290,984 for the same period a year earlier. Net income after taxes amounted to $770,859, equal to earnings of 37¢ per common share, compared with the 1959 third quarter figure of $737,130, or 36¢ per share. The figures for earnings per share of common stock for the nine-month period and the third quarter were computed after preferred dividends, and for 1959 after adjusting shares for a 2 per cent stock dividend effective March 10, 1960.

Corrugating Starch

Coragum FD, a new starch developed for corrugating adhesives, has been announced by Corn Products Sales Co., New York, N. Y. The starch is produced by flash drying, a process which, the company states, produces starch that is more uniform in particle size, composition and moisture content. The method of drying, in a stream of heated air, is reported to eliminate any chance of the particles becoming overdried or case hardened due to partial gelatinization. Among the benefits attributed are: faster dispersion, a more uniform adhesive paste, easy viscosity adjustment, better glue lines, and less scrap loss.

Avery Moves Office

To provide increased service for its customers in the Chicago, Ill., area, Avery Label Co. has moved its offices to the centrally located London Guaranty Building at 360 N. Michigan Avenue. According to John S. Torrey, vice-president and general manager, the relocation of the Chicago office is indicative of the growing importance of pressure-sensitive labels and self-adhesive decorative materials in all types of business and industrial applications in the area.

Speaks on Advertising

"Advertising Adhesives and Sealants" was the subject of an address by E. R. Falkenburg, executive vice-president and general sales manager of the Miracle Adhesives Corp., Bellmore, L.I., N.Y., at a recent meeting of the Rubber and Plastic Adhesive and Sealant Manufacturers' Council. Among the topics covered by Mr. Falkenburg were: determining a budget; apportioning it by trades, products and media; coordinating packaging, promotion advertising and literature; and handling special jobber promotions. "One most important phase in advertising, is emphasis on a specific theme or slogan which ties a market more closely to your products," he pointed out, using as an example his own company's "Construction-by-Adhesion" slogan.

Develops Epoxy Remover

An epoxy remover specifically formulated to safely and thoroughly remove from the hands such materials as epoxies, polyester, phenolic resins, wood glue, and shellac, has been developed by Plaster Supply House, Chicago, Ill. According to the company, prior to the development of the remover, called Epoxy Remover, it was often necessary to use hazardous solvents, often toxic and explosive, to remove these materials. The remover is used after work or before the plastic hardens, and is similar to cold cream in consistency. Plaster Supply reports that in addition to its various components which cleanse so thoroughly, Epoxy Remover contains Lanolin for protection of the skin. It does not contain strong caustics or scouring abrasives, the company states.

"We're in the market for an adhesive that is easily applied to steel, aluminum, cloth, plastic and wood—is nonshrinking, has permanent qualities and is free of cost."

Devcon Sees Sales Rise

Devcon Corp., Danvers, Mass., has predicted that its overseas sales will double in 1960, and that domestic demand for its products will be ahead of last year by 50 per cent. The company has indicated that it will expand its facilities but has not announced details of the expansion, other than that a new manufacturing facility will be built overseas. Albert M. Creighton, president of Devcon, noted that the company's line of products are sold in every country in the Free World and that the sharp increase in demand overseas makes necessary the setting up of new distributors. Mr. Creighton stressed that a shift in export demand is in the making. Previously the bulk of the company's products were sold to industrial users but now, with the upward surge of do-it-yourself in Europe, retail sales are starting to show an increase.

Riegel Earnings Dip

Riegel Paper Corp., New York, N.Y. pointed to decreased earnings during the company's third quarter in a registration statement filed with the Securities and Exchange Commission announcing its plans to raise $10 million through the sale of sinking fund debentures. The company estimated that its earnings in the third quarter "were substantially less" than in the like 1959 quarter and each of the first two quarters of 1960. In the 1959 third quarter Riegel had a net income of $971,798, or 73¢ a share, from sales of $17,925,465. In the first six months of 1960 the company's profits dropped slightly to $1,532,642, or $1.10 a share, from $1,597,200, or $1.15 a share in the first half of 1959, although first half sales for this year rose to $40 million from $36.8 million during the same period last year.

Zagreb Plastics Plant

A plastics and chemicals plant will be built near Zagreb, Yugoslavia, with the assistance of a $23 million loan provided by the Development Loan Fund. The factory will consist of eight processing units which will produce polyethylene, styrene, polystyrene, phenol, and acetone, using locally produced liquefied petroleum gas as the principal raw material. Some of the chemicals produced will be used in the manufacture of resins and adhesives.

ADHESIVES GUIDE

by JOYCE HURD

• A Practical Handbook

designed to serve as a guide to the types of adhesives available for bonding various materials in various applications. This new British publication covers adhesives used in woodworking, bookbinding, footwear, etc., and offers valuable data on the advantages of adhesive bonding and the classification of adhesives.

Topics Covered

Choice of Adhesives for Various Materials.

Encyclopedia of Basic Adhesive Types.

Classification of Manufacturers (British) by Basic Types of Adhesives Made

Catalog of Adhesive Manufacturers and Their Products

Trade Name Index (British)

Miscellaneous Adhesive Recipes

British Organizations Concerned With Adhesives

Bibliography

With contents including data on something like 400 individual adhesives made by about 100 different manufacturers, this publication will prove to be a valuable edition to your technical library. More than 50 main types of adhesives and their properties are covered!

Sole Distributor for the United States and Canada

Palmerton Publishing Company

$3.50

soft cover 140 pp.

For all books destined for foreign delivery, add 50¢ per copy for postage and handling.

Palmerton Publishing Co.,
101 West 31st Street
New York 1, N. Y.

Gentlemen:

Please send me_____copy (ies) of "Adhesives Guide" at $3.50* each.

☐ Money Enclosed ☐ Bill Me

Name_____

Address_____

_____

*New York City addresses add 3% sales tax.

patent review

By MELVIN NORD

Hydrolyzation of Starch

U. S. Patent 2,946,706, issued July 26, 1960 to Edmund F. Boon, Laszlo Vahl, and Wouter G. Kingma, assigned to Werkspoor N. V., describes a process for the hydrolyzation of starch to form a mixture of dextrins, polysaccharides and monosaccharides.

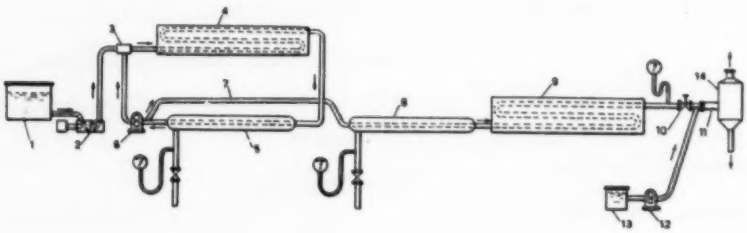


Figure 1

The process is illustrated in Figure 1. From the receptacle (1) the acidified starch suspension is pumped by a dosage-pump (2) into a mixing chamber (3), which is located in a cycle consisting of a reactor (4), a heater (5) and a circulating pump (6). The freshly introduced starch liquor is forced into the mixing chamber through a slot-shaped opening with a high velocity into the circulating mass. The latter, with a smaller velocity, flows along said slot and is already preliminary hydrolyzed in the reactor, whereby higher and lower dextrins and polysaccharides are formed. The circulating mass takes up the fresh starch particles in finely divided state.

Behind the heater a quantity of liquor equal to the amount of freshly introduced starch liquor is withdrawn from the cycle by the conduit (7). The conduit leads the mass through a second heater (8) and subsequently through a second reactor (9), in which the final hydrolyzation takes place. The hydrolyzed product is introduced into a neutralization chamber (11) through an expansion valve (10). A soda solution for neutralizing the mass is continuously supplied to the chamber from a receptacle (13) by a pump (12). The neutralized solution subsequently flows into a flash evaporator (14) in which a low pressure is maintained, so that liquid is evaporated and the mass is also cooled.

Bonding Process

U.S. Patent 2, 943,011, issued June 28, 1960 to Claude A. A. Rayner and assigned to Ciba, Ltd., provides a process for securing adhesion between two surfaces by locating between them a self-supporting film consisting of a synthetic linear caprolactam polyamide having a melting point between 185 and 215° C. The assembly is subjected to a temperature sufficient to melt the polyamide and to a pressure sufficient to hold the assembly together. It is then allowed to cool below the melting point of the polyamide and the pressure is released. The principal improvement provided is that there is applied to the surfaces to be bonded a thin coating consisting of a thermosetting uncured phenol-formaldehyde resin.

Adhering Organic Compound to Shaped Organic Polymer

U.S. Patent 2,940,869, issued June 14, 1960 to Boynton Graham and assigned to E. I. du Pont de Nemours & Co., provide a process for uniting to the surface of a shaped organic polymer a coating of an organic compound which is non-polymerizable and chemically distinct from the shaped polymer.

There has now been discovered a process for uniting to the surface of a shaped organic polymer a coating of a dissimilar non-polymerizable organic compound which is fluid at a temperature below the softening temperature of the shaped organic polymer. In the technique the surface of the shaped organic polymer is first exposed to at least 1 watt-sec./cm.^{2} of ionizing radiation, with an energy of at lease 0.1 million electron volts. Subsequently, in the absence of radiation and while the activity generated by the radiation is still present, the organic compound in fluid form is put into contact with the irradiated surface of the shaped polymer. The coatings or deposits so supplied cannot be removed from the polymer surface by treatment with solvents which normally dissolve the organic compound so added.

Shaped organic polymers suitable for treatment include any normally solid organic polymeric material, particularly those with molecular weights in excess of 500 and especially in excess of 1000. The polymers may be oriented or unoriented, *e.g.*, polyethylene, polystyrene, polybutadiene, rubber, polyisobutylene, butadiene/styrene copolymers and similar polymers

As an example a film of polyethylene 0.002 inch thick is placed in an aluminum box which has a window of 0.0008-inch aluminum foil 4 cm. above the sample. The system is flushed with nitrogen while it is passed twenty times at a rate of 2 cm./sec. under a 250 microampere beam of 2 m.e.v. electrons from a 2-million-volt Van de Graaff accelerator which, at a window-to-sample distance of 10 cm., operates at a scan width of 20 cm. A total exposure of 250 watt-sec./cm.^{2} is delivered over a period of about 20 minutes.

The box containing the irradiated film is removed from the electron beam. Ninety seconds after irradiation is completed, polyethylene oxide of 6,000 molecular weight ("Carbowax" 6,000 W), which has been melted and preheated to 100° C., is

admitted to the system in amount sufficient to cover the film with molten polymer. The system is kept at 100° C. with continued passage of nitrogen for one hour. The film is then extracted for 16 hours with hot running water, followed by extraction for eight hours with ethanol in a Soxhlet extractor.

A control film is similarly irradiated and extracted, but the contacting with polyethylene oxide is omitted. The treated film is unchanged in appearance to the naked eye It is found to have lost 0.50 per cent in weight (compared to the weight of the film before irradiation), whereas the control film loses 0.65 per cent in weight. The water wettability of the films is determined by measuring the angle of inclination at which the retreating edge of a 0.05 ml. droplet of water will travel at a rate of 0.1 mm./second. In this "sliding-tilt angle" test, the treated film, with an average sliding-tilt angle of 50°, is more hydrophobic than the control film, which has an average sliding-tilt angle of 62°.

Magnesium Oxychloride Cements

U.S. Patent 2,939,799, issued June 7, 1960 to Harry E. Chisholm and assigned to Food Machinery and Chemical Corp., provides a composition suitable for mixing with magnesium chloride and water to form magnesium oxychloride cement plaster having a magnesium chloride to magnesium oxide ratio of at least 0.372.

The composition consists of magnesium oxide, inert fillers, and from 0.01-1.5 per cent by weight of a hydrophilic colloid such as water-soluble carboxymethylcellulose.

Polytetrafluoroethylene Adhesive Tape

U. S. Patent 2,946,710, issued July 26, 1960 to Reuben T. Fields and assigned to E. I. du Pont de Nemours & Co., describes a method of producing an adhesive tape suitable for insulating an electrical conductor.

A polytetrafluoroethylene tape is contacted with a solution of an alkali metal in a non-metallic inert solvent. The tape is then treated with nitric acid, and then coated with an uncured resin (silicone resin, epoxy resin, or polyester resin). The tape is then wound onto an electrical conductor, and subsequently the tape and conductor are heated sufficiently to cause the resin to cure.

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Cementing composition containing cement and coconut shell	Texaco Trinidad, Inc.	2,939,798	6/ 7 /60
Strippable label	A. H. Wirz, Inc.	2,940,196	6/14/60
Continuous production of plaster board	The British Plaster Board, Ltd.	2,940,505	6/14/60
Adhesive medical dressings	T. J. Smith & Nephew, Ltd.	2,940,868	6/14/60
Adhesive tape	E. I. du Pont de Nemours & Co.	2,940,884	6/14/60
Sizing of paper	Hercules Powder Co.	2,941,919	6/21/60
Non-tear case sealing adhesive	Swift & Co.	2,943,071	6/28/60
Forming an adherent polyoxide coating on a surface	E. I. du Pont de Nemours & Co.	2,943,955	7/ 5/60
Starch dextrins	Anheuser-Busch, Inc.	2,944,913	7/12/60
Vinylpyridine polymer adhesive composition	Phillips Petroleum Co.	2,944,992	7/12/60

Copies of any patents, including those described here, are available from the Commissioner of Patents, Washington 25, D. C., for 25 cents each. Do not send stamps.

how to
"SKIN"
residue glue from a coating tank...

apply
RELEASE-COTE
the miracle
RELEASING AGENT

Just a thin film of RELEASE-COTE on tank surfaces and it sheds glues and adhesives instantly at clean-up time.

FREE
TRYOUT OFFER!
A generous sample of RELEASE-COTE for you to test. (Note how operators like RELEASE-COTE's gentle-ness to their hands).

Distributed by
POTDEVIN MACHINE CO.
297 North Street, Teterboro, N. J.
World's largest producer of coating machines.

new equipment

Electric Drum Heater

This new, flexible drum heats viscous materials simplifying their removal from the drum. The heater, designed to fit any diameter steel drum from 21½ to 23½ inches, is said to be ideal for users of adhesives, plastics, paints, molasses, oils, greases, fats, and chemicals. The units are flexible and can be wrapped around the drum and easily attached with a simple spring attachment. Once in position, the devices will heat the drum and its contents to

any desired temperature to permit easy removal of the contents, or maintain even temperatures when required. The heater bands are 2½ inches wide and one or more units can be used, depending upon temperatures required. The units are factory tested at 1250 volts dielectric strength and are rated 1000 watts at 115 volts. Special sizes are available on request. *Electro-Flex Heat, Inc.* **E-249**

Stirrer Motor

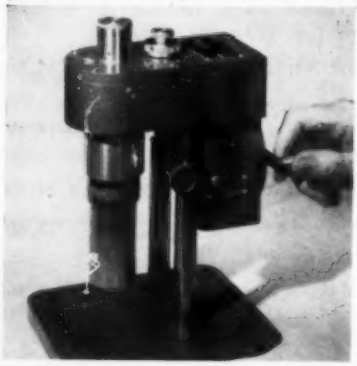
This stirrer motor with three separate drive shafts has each shaft with its own rpm and torque range. According to the manufacturer, this, in conjunction with the use of a taper-wound rheostat, permits varying speeds from 50 to 6000 rpm. *Kontes Glass Co.* **E-250**

Space-Saving Dissolver

Specially designed for "through-the-floor" operation to save space, the dissolver may be mounted on upper floors, walkways, balconies, or other locations which permit the impeller to operate in tanks installed below floor levels. Production can be piped direct to lower areas for further processing or packaging, since many products can be completed on the dissolver without the necessity for milling, the manufacturer states. Available in 40 to 75 hp sizes, the dissolver is equipped with hydraulic lifts and maximum power delivery drive systems. The hydraulic lift mechanism is constructed to allow cylinder to operate through the floor, providing 66 inches of the mixing mechanism, to clear tanks. The drive system is said to be capable of delivering over 90 per cent motor horsepower to impeller, even at slowest speeds. Speeds may be changed at any time without stopping, and the impeller can be swung in a 270 degree arc. *Morehouse-Cowles, Inc.* **E-251**

Portable Viscometer

A completely portable viscometer with a hand cranked drive, Model HC34 is said to be ideal for field service because it eliminates the need



for bulky storage batteries and power packs. The manufacturer states that one of the main features of the viscometer is the drive's constant high-low speed ratio which makes possible accurate measurements by the two point method. *Fann Instrument Corp.* **E-252**

Transfer Tape Dispenser

The 4DF dispenser is designed for applying the manufacturer's 04 transfer tape. The machine is compact and lightweight, being only 15 inches long and can be operated with one hand. The dispenser removes the tape interliner and applies the double coated tape in up to 1 inch widths directly to a variety of surfaces such as glass, wood, plastic, metal, and boxboard. The tape is cut with a squeeze of the trigger and an exposed tab is left to provide a start for the next strip assuring that the

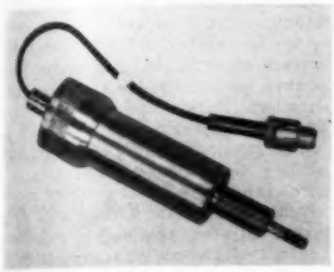
tape is always ready for use. A special silicone rubber wipedown roller automatically presses the tape firmly to the surface and provides excellent release characteristics. Made of durable metal in a gunmetal finish, the 4DF dispenser applies any length strip desired. The manufacturer states that the unit is ideal for application where instant, extremely thin bonding is required. Only 4 mils thick, the tape is an economical means of imparting pressure-sensitive qualities to Teflon, Mylar, polyethylene, etc., the company claims. In addition, no set-up time is required when laminating various materials, mounting nameplates, face plates, adhering mirrors in compacts, and decorative trim. *Permacel.* **E-253**

Precision Force Gage

Designed to meet the need for a larger capacity force indicator calibrated in grams, Model L-14000M force gage has a maximum capacity of 14,000 gm. The force gage uses a compensated spring mechanism and a dial indicator with 140 divisions. The over-all accuracy of the unit is ½ of 1 per cent of full scale, equivalent to ±70 grams, the manufacturer claims. Designed for easy hand operation or for use in permanent test set-ups, Model L-14000M is said to be able to hold the maximum dial reading after the load has been removed. *Hunter Spring Co.* **E-254**

Differential Transformer

An Encapsulated Differential Transformer with an over-all length of 5 21/32 inches and a width of 1 5/16 inch has been developed for measuring instrumentation. The transformers have effective measuring ranges of 0.1 inch and 0.2 inch depending on the particular read-out or recorder used with them. The built-in zero adjustment of the new encapsulated transformers starts the differential transformer core position on the same zero as the read-out or recorder, simplifying the initial set-up and the use of many transformers with the multi-point recorder, it is reported. The instrument can be used in any position without affecting either accuracy or sensitivity. *Riehle Testing Machines.* **E-255**



Non-Destructive Tester

A new instrument for gaging the thickness of coatings on iron and steel, Type ES Permascope is said to provide a non-destructive means of measuring thicknesses or organic and non-magnetic metal coatings (including phosphate) with the accuracy of the microscopic method. It is reported to be suited for testing coating thicknesses on piston rings, thin wire, screws, nuts, pipes and cylindrical containers. The Permascope features a small, 2-pole probe which works on the principle of a magnetic amplifier. To measure the thickness of a coating, the probe is simply applied to the surface. *Twin City Testing Corp.* **E-256**

Spectrophotometer

The latest in the company's line of Infracord spectophotometers, Model 137G was designed for high resolution analyses in the near infrared and adjacent infrared regions. It is said to permit the study of absorption and structure correlation in the C-H stretching and carbonyl regions; also in the hydrogenic and combination bands of the near infrared. *Perkin-Elmer Corp.* **E-257**

Compression Testing Machine

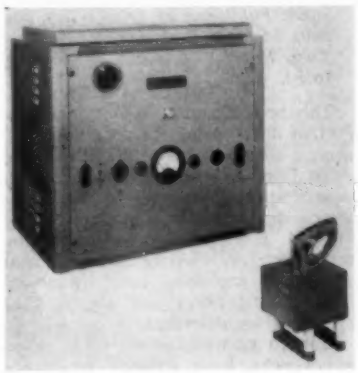
A new compression testing machine which features an integral recorder which automatically plots pressure and package deflection on a graph chart for a permanent record of each test. Designed specifically for compression tests on shipping containers, packages and packaging materials, this machine is particularly suited for both large volume tests or sample testing on containers of varying sizes. A platen height adjustment permits change over from maximum opening for large containers to minimum settings in seconds. According to the manufacturer, the compression tester meets ASTM standards for compression testing of shipping containers and has a system accuracy of ±1 per cent of full scale including recorder. The tester is available with three standard compression ratings—2,000, 5,000, or 10,000 pounds, and three height load openings—48, 60, or 72 inches. Maximum width and depth load openings are 40 inches. *L.A.B. Corp.* **E-258**

Bench-Type Coater

The new Walco bench-type coater applies coating materials to any flat or compressible surface with predetermined, uniform thickness, the manufacturer reports. The unit, Model 55-D-1, is said to be a new development in an underside roller coater for use with contact cements applied to sponge rubber materials for cushions, pillows, mattresses, etc. The coater efficiently applies adhesives, paints, enamels, oils, cements and other coating materials to metals, Masonite, plywood, paper products, fabrics and other flat surfaces, the manufacturer states. The coater is available in lengths from 8 to 72 inches. *L. R. Wallace & Co.* **E-259**

Electronic Wood Gluers

Designed to do a fast gluing job, these gluers are said to dry and set an adhesive bond in up to 2 inches of wood in seconds and permit handling work immediately. The manufacturer reports that this high speed electronic gluing equipment has been used in a number of woodworking applications including: edge bonding veneers and plastic laminates to table, desk, and counter tops; setting mortised, dowelled and tongue and groove joints; setting glue blocks; applying wood paneling to joists and furring strips; patching veneers, toys, sash and doors, cedar chests, and patternmaking. Three models are available, one with a hand gun weighing less than 3 pounds. A number of electrodes are available to use with the hand gun. *Weldotron Corp.* **E-260**



Hand-Held Epoxy Spray Gun

The Plasmatron Plasma Jet Spray Gun is said to be capable of spray depositing epoxy resins onto any surface for coatings of virtually any desired thickness. According to the manufacturer, epoxy coating deposited by this technique is extremely durable and does not need further curing. In addition to this exceptional bonding, the company claims extreme penetration of the resins with the spray technique. Because of the bond formed, thinner coatings of epoxy may be used, and may be applied rapidly, the company states. *Plasmadyne Corp.* **E-261**

FOR MORE INFORMATION on these new products use the Readers Service Card in this issue.

book reviews

Introduction to Textiles. *By Evelyn E. Stout. Published by John Wiley and Sons, Inc., 440 Park Ave. South, New York 16, N.Y. 6 x 9¼ in. 363 pp. $6.50.*

This book describes some ninety important fibers, using the definitions and generic classifications of the new Texile Fiber Products Identification Act. Particular attention is paid to wash-and-wear developments, mixtures, and blended fabrics. Modern texturizing processes for thermoplastic filament yarns are explained carefully. Non-thermoplastic fibers and natural fiber processes are described.

Bonded or web fabrics, often called non-wovens, have attained acceptance largely since 1950. They are made of fibers that have been laid down in a sheet or lap and are held together by an adhesive bonding agent. Dr. Stout defines, discusses and describes various bonding techniques, as well as mentioning the new sprayed-fiber fabric announced last year and still in the speculative phase.

Students without extensive chemistry, new-comers to the textile field, and the general consumer will appreciate this book. Dr. Stout's long experience in textile research and college teaching contributed to the organization and content. The study begins with the smallest units —the fibers—goes on to yarns, then to fabrics. Attention is given to allied topics and some chemical formulas have been included. Finally, the properties of fibers, yarns and fabrics are related to fabric performance and quality. New or unfamiliar material is dealt with in length, and is data for which it is difficult to find much reliable reference information.

Crushing and Grinding. A Bibliography. *Published by Chemical Publishing Co., Inc., 212 Fifth Avenue, New York, N.Y. 6 x 9¼ in. 425 pp. $10.50.*

This bibliography, the only one of its kind, has been designed to help chemical engineers, chemists, technicians, and manufacturers in solving their problems and increasing the efficiency of crushing and grinding operations in their plants. The book is divided into two main sections. The first consists of short reviews, each written by an expert in the field, on the most important aspects of crushing and grinding raw materials for various chemical industries.

The principal part of the book is the second section. Abstracts and annotations of 2,800 articles and books, published from 1920 until now, are featured on all phases of crushing and grinding. Included are discussions of theoretical aspects, operation techniques, many types of equipment and their efficiency, raw materials that are crushed or ground, particle size and surface area determination, and industrial hazards and their elimination. Every progress minded technical person in the adhesives field will welcome this treasury of information.

Biological Treatment of Sewage and Industrial Wastes, Volume II. *Edited by Brother Joseph McCabe and W. W. Eckenfelder, Jr. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y. 6 x 9¼ in. 330 pp. $11.50.*

This is the second volume, sub-titled "Anaerobic Digestion and Solids-Liquids Separation," in a series covering the entire field of biological waste treatment. Twenty-eight papers have been contributed by leading authorities and arranged in logical sequence. The papers were presented at a conference held at Manhattan College in April 1957.

Three separate sections in this volume cover anaerobic treatment, sedimentation and flotation, vacuum filtration and sludge conditioning. The first volume covered the principles of aerobic oxidation and aeration, and their applications to process design for the treatment of municipal and industrial waste waters. Chemists, industrial and sanitary engineers, municipal officials and all others concerned with waste treatment problems will find this series of tremendous help in understanding the methods of biological waste treatment.

Welding of Plastics. *By J. Alex Neumann and Frank J. Bockhoff. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y. 6 x 9½ in. 279 pp. $7.25.*

The subject is treated comprehensively, from initial design procedures to final detailed fabrication methods. Various physical and chemical properties of individual plastics, presently used for welded construction, are completely covered for use in chemical and allied processing. All presently known techniques of welding are covered in detail. Many step-by-step procedures are included with photographs. In addition, the book contains one of the most complete corrosion resistance tables yet published, plus a concise guide for the choice of a plastic construction material.

The most recent welding materials, such as linear polyethylene, polypropylene, chlorinated polyethers, and the newer fluorocarbons are covered in detail. In addition, the newest welding techniques are presented in a complete, up-to-date manner. An entire chapter is devoted solely to design considerations as they specifically affect welded construction. Testing and evaluation are also given separate treatment.

The pioneers in the field of plastics welding were men who were experienced principally in the fields of metal welding and metal fabrication. This book is of substantial help to engineers and manufacturers who are interested in present and potential applications of plastics in the process industries. Data on various plastics are given in tables throughout the text as a guide to intelligent use of plastics.

Trade Literature

Designer's Fact Book. The 1961 edition of "Formica Designer's Fact Book" is a completely revised technical reference book on laminated plastics. The new 115-page edition contains property and application data covering 70 standard, special and molding grades of high pressure thermosetting laminating plastics, military specifications, a grade comparator chart, tolerance and weight specifications, information on coast-to-coast fabricating facilities, district office listings, and is fully illustrated. *Formica Corp.* L-295

Sodium Silicate Adhesives. The folder, entitled "Versatile Sodium Silicate Adhesives," describes the properties and applications of the material. It points out that inorganic sodium silicates are particularly adaptable to a variety of materials such as paper, ceramics, asbestos, mica, wood, wool, hair, nylon and metal foil. They are used for laminating, pasting, sealing and flocking. Industrial application, principles of adhesion, and adhesive modifications as related to setting time and special applications are covered. *Philadelphia Quartz Co.* L-296

Vinyl Ethyl Ether Resins. Surface Coatings Technical Release No. 27 is a new brochure describing Bakelite Brand vinyl ethyl ether polymer bases for pressure-sensitive adhesives. The 12-page booklet lists typical properties; viscosity; color; toxicity; stability; solubility; and compatibility with other resins and with additives. A section on formulating and processing discusses adhesive films, caulking compounds, and extrusion lamination. A list of suppliers is also included in the booklet. *Union Carbide Plastics Co.* L-297

TECHNOLOGY OF ADHESIVES AT YOUR FINGERTIPS

SERVICE

Subscribers to ADHESIVES AGE may now obtain, from one central source, technical literature dealing with all aspects of the adhesives industry. One or more of the books listed here may be of invaluable assistance to you. Look this list over and check the books suited to your needs.

- **Adhesive Bonding of Reinforced Plastics—H. A. Perry. $8.75.** Survey of the design and assembly of structures and products, particularly glass-fiber-reinforced plastic products, by means of adhesives. Gives data on equipment and methods used to produce adhesive bonded joints. ☐

- **Adhesive Bonding of Metals—G. Epstein. $2.95.** Considers adhesives used with metals, indicating when an adhesive-bonded joint is advantageous; the type adhesive to use; how to use it, and how to design the joint for optimum performance. ☐

- **Epoxy Resins—Their Applications and Technology—H. Lee and K. Neville. $8.00.** Guide to the field of epoxy resins, covering the chemistry of their preparation and applications, including a section on adhesives. ☐

- **Polyamide Resins—Donald E. Floyd. $4.50.** Discusses in detail various important applications of the polymers belonging to the polyamide resin family and includes a comprehensive section on adhesives. ☐

- **Principles of High Polymer Theory and Practice—A. X. Schmidt and C. A. Marlies. $13.50.** Study of the principles of high-polymer theory and practice, with a section on adhesives, their applications, and mechanisms and factors involved. ☐

- **Recent Advances in Gelatine and Glue Research—G. Stainsby (Editor). $12.00.** Study of Collagen, and its protein gelatine, comprising papers and Proceedings of an International Conference of the British Gelatine and Glue Research Association. ☐

- **Vinyl Resins—Mayo Smith. $5.75.** Surveys applications of vinyl resins with information on their types, properties, chemistry, manufacture and fabrication. Includes information on several types of adhesives in this category. ☐

- **Epoxy Resins—Irving Skeist. $5.50.** A chapter on adhesives is included in this complete study of the entire field of epoxy resins. The author gives formulations, trade names, methods of manufacture and applications. ☐

ADHESIVES AGE
101 West 31st St.,
New York 1, N.Y.

For all books destined for foreign delivery, add 50c per copy for postage and handling.

Please send book(s) checked above to:

Name .....

Company .....

Address .....

.....

Trade Literature (Cont'd.)

Clay Tile Installation. An architect's, builders' and contractors' handbook on the Miracle Thin-Set Adhesive method of installing genuine clay tile, this publication comes complete with numerous illustrations and diagrams. Details are given for application of wall tile, ceiling tile, exterior tile, and floor tile. There are listings of suitable surfaces and special recommendations for each, and the booklet also discusses problems cases such as setting tile over damaged plaster, and floor construction over uneven concrete or wood base. The line of Miracle products for leveling, priming, setting, grouting and caulking, as well as the adhesives for special applications involving high temperatures, chemical resistance and high strengths are described in detail together with the uses for which the manufacturer recommends them. The publication also supplies contractual and legal specifications for use in this work, together with a "short form specification" which provides for legal inclusion of the handbook itself as part of the job contract, if so desired. *Miracle Adhesives Corp.* **L-298**

Glue-Lap Production. Technical specifications for corrugated container glue-lap production are described in this 10-page report which includes a review of synthetic resin emulsion glues designed specifically for this purpose by the company. The report lists structural requirements for glue-lap adhesive products, machining or operational characteristics, basic adhesive types, and a description of the effect of high temperatures and shearing stress. It also includes product specification data such as viscosity, solids, speed of set, heat and moisture resistance, polymer type, pH, color, weight per gallon, storage life, and prices. *Borden Chemical Co.* **L-299**

Stabilizing Adhesive Viscosity. Viscosity stabilization of corrugating adhesives is the subject of a new technical data sheet called T. I. 309. The four-page bulletin discusses the use of colloidal attapulgite additive, known as Attagel 30, as a viscosity stabilizing agent. Results obtained both in the laboratory and in actual production applications with starch adhesives are presented, and the methods of applying Attagel 30 are discussed. A typical stabilized adhesive formula is also given. The bulletin also illustrates the effect of the new stabilizing agent graphically. *Minerals & Chemicals Corp. of America.* **L-300**

Urethane Coatings. A series of 12 clear urethane coatings are described in this 4-page information file. Claimed to provide finishes with greater resistance to scratching and wear, weathering and chemical atmospheres, the coatings are described, and a chart provides general, physical, chemical and mechanical properties for each of the 12 related numbers. Described as a balanced series, the chart shows the 12 numbers in four basic classes of formulations. Designated File 1-60, the literature also includes suggested applications. Some of the formulations described are flexible and are said to have high adhesion for rubbers and other synthetic products, such as conveyor belts, hose and automotive products. *B. B. Chemical Co.* **L-301**

Foam Control. Methods for efficient foam control are presented in a new comprehensive booklet on silicone antifoamers. Entitled "ABC's of Defoaming," the 8-page manual tells where and how silicones actually reduce processing time and maintenance costs and increase production capacity and efficiency. The illustrated manual also lists the silicone defoamers permissible in foods under the Food Additives Amendment. *Dow Corning Corp.* **L-302**

Coatings Selector. The coatings selector is a guide to the selection of specialty coatings available for application on plastics, metals, glass and wood. The charts, which can be mounted for ready reference, show the uses and characteristics of the company's spray, dip and flow coating materials, vacuum metallizing coatings, and standard plastisol formulations. *Bee Chemical Co.* **L-303**

Aliphatic Organic Chemicals. In this new catalog on the company's aliphatic organic chemicals, specifications of more than 200 fatty acids and fatty nitrogen derivatives are covered and typical applications for each group are shown. The 12-page booklet is in chart form for easy reading. Also included is information on the manufacturer's facilities. *Armour Industrial Chemical Co.* **L-304**

FOR MORE INFORMATION on the trade literature reviewed here, use the Reader's Service Card elsewhere in this issue.

Pressure and Temperature Recorders. Designated Catalog 800, temperature and pressure recorders are described in this 8-page booklet. Spiral bourdon tube and bellows type pressure elements are pictured, with materials and performance characteristics listed. Temperature elements described include the following type of actuation: mercury, vapor pressure, gas pressure and organic liquid. A table lists thermal element characteristics for each type. Photographs highlight mechanical construction features including movement, pen arm, pens, chart drives, access plates and a bellows element in position in the recorder. Listing of optional construction features assists in specifying recorders for special applications. The catalog also includes diagrams showing case dimensions, plus details of pressure and temperature connections. *United States Gauge Division of American Machine & Metals, Inc.* **L-305**

Gravitometer Manual. This 19-page Catalog Booklet 314, covers applications, installation, operation and maintenance of the Sinclair-Cenco 35090 continuous recording Gravitometer. It is fully illustrated with photos, graphs, charts and diagrams, and offers five sections: an introduction, and sections covering description, installation, operation and maintenance. Diagrams show how the measuring instrument functions and describe the electrical set-up for the transducer, power supply and gage adjustment. Included is a two-page table for converting A.P.I. degrees into per cent of span in the gravity range of 30° to 70° A.P.I. *Central Scientific Co.* **L-306**

Defoamers for Animal Glue. An eight-page booklet which calls attention to the problem of foam formulation in the extraction and evaporation processes as well as foam problems in adhesive and sizing manufacture and in end use applications. Designated PC-18, the booklet lists defoamers available for hide and bone glues, and discusses the question of how much defoamer is to be used, how to add defoamer, and the fish eye problem. *Nopco Chemical Co.* **L-307**

Adhesives for Tile. A 20-page, illustrated handbook describing the company's line of adhesive products for thin set genuine clay tile. The booklet, designated AIA-23P, lists the types of tile adhesives available and their advantages. A section on specifications discusses such factors as contractural and legal; scope of work; materials; general provisions; installation procedure; and results. The booklet also gives instructions for setting wall tile, ceiling tile, exterior tile, and ceramic floor tile. *Miracle Adhesives Corp.* **L-308**

CANCER'S DANGER SIGNALS

CAN BE SAFETY SIGNALS

You can do **two things** to guard yourself against cancer: Have an annual health checkup. Alert yourself to the seven danger signals that could mean cancer:

1. Unusual bleeding or discharge. 2. A lump or thickening in the breast or elsewhere. 3. A sore that does not heal. 4. Change in bowel or bladder habits. 5. Hoarseness or cough. 6. Indigestion or difficulty in swallowing. 7. Change in a wart or mole.

If your signal lasts longer than two weeks, go to your physician. Give him the chance to give you the chance of a lifetime.

AMERICAN CANCER SOCIETY

CLASSIFIED ADVERTISING

DECEMBER, 1960

Rates: All Classifications except Positions Wanted:

Undisplayed, per inch or fraction..$20.00

Boxed, per inch or fraction.....$25.00

(Approximately 60 words per inch unboxed; 50 boxed. Count 5 words for box number address.)

Positions Wanted:

Set solid, no separate headings or boxes ..... $2.50 for 25 words or less; extra words, 10¢ each. Count 5 words for box number address.

Replies will be forwarded via ordinary mail without charge.

Note: Cash must accompany order.

POSITION WANTED

MARKETING: Extensive, varied experience in technical sales, promotion, market surveys and development of adhesives sales to packaging and laminating industries. Address Box A-164-P, ADHESIVES AGE.

HELP WANTED

ADHESIVES CHEMIST

Young, fast-growing plastics firm in an attractive college community near Minneapolis is looking for an experienced development chemist to carry out laboratory development projects in thermoplastic and thermosetting tapes and adhesives. This is a one-man position calling for both creative individual effort and the ability to work easily with others in resolving special applications problems. He will have a modern, well-equipped laboratory and an attentive ear to requests for additional equipment. This job offers a distinct opportunity for personal responsibility and achievement. Please include present salary in reply to: S. M. HUNTER, G. T. SCHJELDAHL COMPANY, NORTHFIELD, MINNESOTA (Fabricators of the world famous ECHO "Satelloon").

ADHESIVES SALESMAN

This is a key spot in an up-and-coming company for a man who knows how to sell elastomer-type adhesives to industry. He should be technically-minded as he will work in close cooperation with our laboratory and with customers' project engineers. The man selected must be able to analyze mechanical problems in adhesive applications and to suggest sound, profitable solutions. Opportunity is gigantic. Only those with experience and following will be considered. Mail your resume of experience, etc., to:

Stan L. Ostrenga, National Sales Manager
MYSTIK ADHESIVE PRODUCTS, INC.
2635 N. Kildare Avenue
Chicago 39, Ill.

ADHESIVES ENGINEER

Chemist or Ch.E. Experienced. To head up research, development and production of adhesives for ceramics, floorings, structural and specialty items. Salary open. Established growing company in Western Pennsylvania. Reply in confidence. Address Box A-168-H, ADHESIVES AGE.

EQUIPMENT FOR SALE

FOR SALE: 1800 gal. T316 stainless reactor, jacket & agit. Baker-Perkins size #15-UUMM dispersion mixer, jacketed, cored dispersion blades, 100 HP XP drive, compression cover, motorized tilt. Also Baker-Perkins 150, 200 gal. double arm jacketed mixers. PERRY EQUIPMENT CORP., 1414 North 6th St., Philadelphia 22, Pa.

ADVERTISING SALES STAFF

Advertising Sales Manager
CHARLES T. JANSEN

Advertising Representatives

GERALD F. WALTHEW
101 West 31st St.
New York 1, N .Y.
Phone: Pennsylvania 6-6872

F. ROYAL CAREY
68 Shenandoah Road
Warwick, R. I.
Phone: Turner 4-9624

JIM SUMMERS & ASSOC.
35 East Wacker Drive
Chicago 1, Ill.
Phone: Andover 3-1154

CHRIS DUNKLE & ASSOC.
740 South Western Ave.
Los Angeles 5, Calif.
Phone: Dunkirk 7-6149

420 Market St.
San Francisco 11, Calif.
Phone: Sutter 1-8854

B. G. EDSTROM
15605 Madison Ave.
Cleveland 7, Ohio
Phone: Lakewood 1-7900

ADVERTISERS' INDEX

DECEMBER, 1960

Adhesion	8
Adhesives Guide	57
Air Reduction Chemical Co. Colton Chemical Co.	19
American Latex Products Corp.	3
Brinkmann Instruments, Inc.	4
Darling & Co., Glue Div.	5
DuPont de Nemours, E. I. & Co., Inc.	Cover 3
Dural Co., Inc.	8
Monsanto Chemical Co.	15
National Starch & Chemical Corp	Cover 4
National Tuberculosis Assn.	53
Pennsylvania Industrial Chemical Corp.	17
Permacel	11
Philadelphia Quartz Co.	9
Potdevin Machine Co.	59
Rubber & Asbestos Corp.	6
Rubber to Metal Bonding	55
Schenectady Varnish Co., Inc.	21
Schwartz Chemical Co.	Cover 2
Semco Sales & Service Inc.	9
Shawinigan Resins Corp.	13

in passing

Up in Smoke

Instead of just asking whether you want your favorite brand in pack or flip-top box, clerks may some day be inquiring, "What flavor do you want?" According to the *New York World Telegram*, tobacco processors' chemists are ready to produce cigarettes with such flavors as chocolate, cinnamon, brandy, cloves, ginger and cocoa . . . And speaking of tobacco, a tobacco manufacturer suffered a delayed and unexpected expense in a toe amputation case when an unwary customer bit into a plug containing a portion of a human toe. *National Safety News* reports that the judge said: "We can imagine reason why, with ordinary care, human toes could not be left out of chewing tobacco, and if toes are found in chewing tobacco, it seems to us that somebody has been very careless."

Signs of the Times

A laconic statement in the financial section of various New York newspapers dated October 18, 1960, read as follows. "Comptometer Corp. said yesterday it has agreed to buy Worthington Ball Co. of Elyria, Ohio, manufacturers of golf balls, for an undisclosed cash sum." This can only mean one thing. Golf balls are to be constructed with built-in counting devices in their innards. No longer will it be possible for the care-free hacker to accidentally lose track of a few errant strokes in the bushes or traps. Instead, everything will be a matter of tragic record. Perhaps, in the long run, it's all for the best, but in the beginning those high scores could be hard to digest. Especially if one of your favorite golfing cronies was the one who insisted that you use the new ball!

Need A Pacifier?

Less than one of every nine persons in the U.S. took tranquilizers in 1959, David D. Stiles, director of market development at Abbott Laboratories, says. His figure is based on 20,700,000 new prescriptions filled during the year.

Parking Problem

The only reason that Elliot A. Wright was collecting the nickels from the Keene, N.H., parking meters was because the regular meter watcher was ill. Mr. Wright, a tax collector, feels he was wronged. When he returned to his car with a bucket of change, he found a parking ticket.

Work Breakdown

Chemists spend more time communicating than they do on research in the laboratory, according to studies by the Case Institute of Technology. The average work week is broken down as follows: 16.5 hours in scientific communication; 6.7 hours in business communication; 15.9 hours in other scientific work. This adds up to 39.1 hours and we can only assume that the remaining .9 of an hour represents coffee break time.

Management

Business Week asks if we realize that a bootlegger is a management man? The publication says it ran across the book that the Census Bureau uses to classify people. It's called, *Classified Index of Occupations and Industries*, and the following are listed under "Managers, Officials & Proprietors": horse trader, ferryboat pilot, bathhouse keeper, peddler, pushcart stablekeeper, ragpicker, Indian trader (Is this a trade of Indians or an Indian who trades?), popcornstand keeper, and ticket scalper. Oh, and also racketeer and bootlegger. Among the "Professional & Technical," according to the Bureau, are: balloonist, tattoo artist, snake charmer, organ grinder, truant officer, medicine man, bird doctor and medium. And last, but by no means least, impersonator.

In Merrie England

A young man in Rednal, England, was recently fined $8.40 for a traffic violation. The official report noted that he was "driving a motorcar in such a position that he could not have proper control." His argument that he *did* have proper control of his automobile didn't stop the fine from being levied—he had been arrested while driving with a girl on his lap.

Wined and Dined?

This a question Rep. H. R. Gross (R-Iowa) asked as 3.6 billion dollar foreign aid bill came up for debate in Congress. A "well oiled" item in the bill appropriates $450,000 for whiskey and food, presumably to be consumed while foreign aiders discuss continued requirements of assorted friends overseas.